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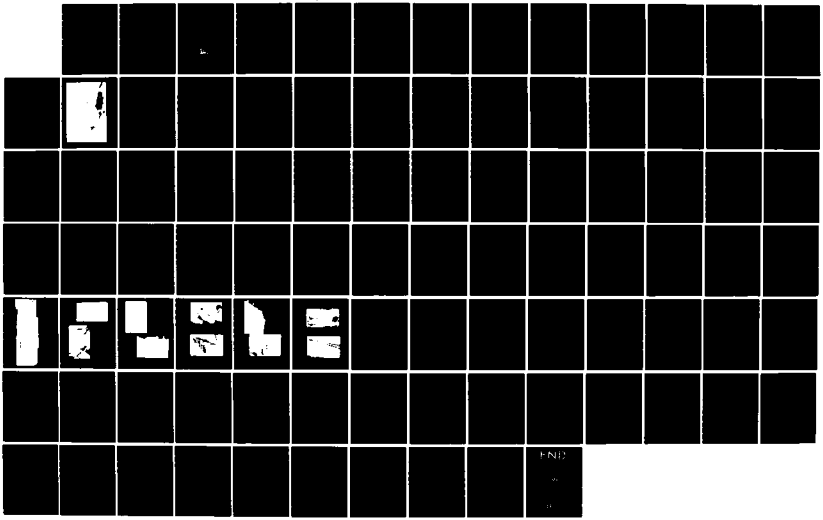

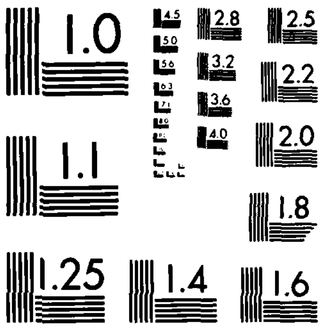
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RICHELIEU RIVER BASIN
WOLCOTT, VERMONT

WOLCOTT DAM
VT 00179

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE, 1980

REPRODUCED AT GOVERNMENT EXPENSE

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1. REPORT NUMBER VT 00179	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Wolcott Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE June 1980
		13. NUMBER OF PAGES 45
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Richelieu River Basin
Wolcott VT.
Lanoille River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

TTe dam is a reinforced concrete gravity structure about 384 ft. long and 51.87 ft. high. The dam is in fair condition. Structural and mechanical condition is good. It is intermediate in size with a high hazard potential. There are various recommendations and remedail measures which must be undertaken by the owner.

WOLCOTT DAM

VT 00179

RICHELIEU RIVER BASIN
WOLCOTT, VERMONT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LETTER OF TRANSMITTAL
FROM THE CORPS OF ENGINEERS TO THE STATE

TO BE SUPPLIED BY THE CORPS OF ENGINEERS

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Identification Number:	VT 00179
Name of Dam:	WOLCOTT DAM
Town:	WOLCOTT
County and State:	LAMOILLE COUNTY, VERMONT
Stream:	LAMOILLE RIVER
Date of Inspection:	MAY 6,7,8, 1980

The dam, constructed about 1920, is a reinforced concrete gravity structure approximately 384 feet long and 51.87 feet in height. The upstream face is vertical, the downsteam face is typically sloped at 7-5/8 horizontal to 12 vertical. The top is flat and of varying width except for the divided spillway, which has an ogee crest. The dam includes a 120 foot long spillway section on the right side, a central sluiceway pier with manually operated sluice gate controlling a 6 foot diameter low level outlet at the dam base, a 66 foot long spillway section to the left of the sluiceway pier, and a left abutment section with an intake structure and controls for two 6 foot diameter penstocks for power generation. All gates and controls are reported operable. Both spillway sections are at equal elevations. A 16 foot high concrete dike exists on the right bank of the flowage approximately 150 yards upstream of the main dam.

The dam is on the Lamoille River approximately 40 miles upstream from Lake Champlain. It was constructed and is presently used for power generation. The reservoir is 2500 feet long with a surface area of about 12 acres. Normal storage capacity is estimated at 258 acre-feet.

Based upon the visual inspection and the review of available data regarding this facility, the dam is considered to be in FAIR condition. This assessment is based primarily upon concerns regarding spillway hydraulic capacity and effect of flashboards on dam stability. Structural and mechanical condition is good.

In accordance with the Corps of Engineers Guidelines and the size (INTERMEDIATE) and hazard (HIGH) of this dam, the Test Flood is equivalent to the Probable Maximum Flood (PMF). Peak inflow to the Wolcott Dam reservoir is 117,863 cfs; routed Test Flood outflow from the dam is 114,800 cfs with the water elevation 10.6 feet over the dam crest. The spillway capacity is 18,672 cfs, which is equivalent to 16% of the routed Test Flood outflow from the dam.

It is recommended that the owner engage a qualified, registered engineer to assess the significance of the seepage occurring on the downstream faces of the dam and the dike, to determine the effect of the currently-used flashboard system on dam stability, and to perform a detailed hydrologic and hydraulic investigation to further assess the need for and means to increase the project discharge capacity. It is also recommended that the moss, trees and debris on the face and within 10 feet of the toe of the existing dike be removed. These and remedial measures which are discussed in Section 7 should be instituted within one year of the owner's receipt of this report.

Stephen D. Murray, P.E.
Project Manager
James W. Sewall Company

STATE OF MAINE
STEPHEN
D.
MURRAY
2736
REGISTERED
PROFESSIONAL ENGINEER

This Phase I Inspection Report on   Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

THIS SHEET TO BE FURNISHED BY THE CORPS OF ENGINEERS

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff"), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General - Normal procedure is to generate power continuously at times of high water, curtailing evening operation to maintain the pool elevation when the river flow is less adequate. There is an occasional drawdown of the pool for maintenance purposes.

b. Warning System - There is no formal warning system, but an operator is on duty when the station is operating and is able to report any unusual occurrences.

4.2 MAINTENANCE PROCEDURES

a. General - Routine maintenance such as lubrication and equipment cleaning is performed under the direction of Mr. William Fee, Superintendent for the Village of Hardwick on a scheduled basis by on-site operators. Major maintenance is performed on an "as necessary" basis.

b. Operating Facilities - The operating facilities including gates for the penstocks, motorized rake for the trashrack and the sluice gate are in generally good condition, indicative of adequate maintenance.

4.3 EVALUATION

The operation and maintenance procedures at this dam are adequate to ensure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written warning system to follow in the event of flood flow conditions or imminent dam failure.

3.2 EVALUATION

On the basis of visual examination the dam is considered to be in fair condition.

Minor seepage was noted at two points on the dam face and at two points on the dike face. These are not considered indicative of any current structural problem.

Openings for flashboard attachment were incorporated into the dam renovation work performed in 1948. It is unknown what provision, if any, was made in the original dam design for flashboard attachment.

The reinforced concrete ice protector enclosing the sluice gate supports has eroded to the extent that ice or debris interference with sluice gate operation is possible.

A hairline crack is evident at the bend in the left abutment wall. This is not considered structurally significant at this time.

Moss and debris have accumulated on the outside of the dike wall in sufficient quantity to make observation of concrete condition and seepage sources difficult.

Outlet

A low level reservoir outlet is located in the approximate center of the dam as shown in Photos 2 and 3. Access is via a steel truss footbridge from the left abutment, in good condition but exhibiting moderate rusting. The outlet is sufficiently low to relieve hydrostatic pressure on the dam and to facilitate dam repair. The gear operator for the sluice gate on the outlet is shown in Photo 8. This equipment appears in good condition and is reported operable. There is moderate erosion, visible at the extreme right of Photo 7, at the water line of the concrete ice protector enclosing the sluice gate supports. The outlet is a 6 foot diameter steel lined conduit about 10 feet above the bedrock foundation.

Concrete Dike

About 150 yards upstream of the dam site, on the right side of the reservoir, is a concrete dike 125 feet long, 3 feet across the top and 16 feet high at its highest point. The dike prevents by-passing of the dam by overflow from the reservoir via a gully through which the Lamoille Valley Railroad tracks pass. It appears in good structural condition with some spalling of the surface concrete.

The dike is shown in Photos 9 and 10. On May 8 the reservoir water surface was 5 feet below the top of the dike.

There is some very minor clear seepage at the base of the dike near its downstream end and slight seepage from a 2 inch plugged pipe, of unknown function, in the dike. The outside face is partially moss-covered, and a few hardwood saplings have taken root in the organic debris on and at the foot of the dike. In the gully below the dike is a mixture of small hardwood trees, 2 to 6 inches in diameter.

d. Reservoir Area - The reservoir is long and relatively narrow, as is typical for a run-of-the-river dam. The reservoir banks are wooded, with no indications of instability in the vicinity of the dam.

e. Downstream Channel - The downstream channel below the spillway and outlet works, shown in Photos 11 and 12, is moderately steep, clear, and free of obstructions. Bedrock is exposed along the entire channel. Downstream channel banks are typically ledgy and forested with mixed growth as shown in Photos 12 and 13. Approximately 3000 feet downstream of the dam, Vermont Route 15 is carried over the river by the pair of highway bridges with an island between as shown in Photo 13. Within the next 3000 feet are three more bridges spanning the river - one railroad and two roadway. Development along most of the channel bank is sparse, and buildings are considerably above channel level. The Town of Wolcott, about 6000 feet downstream of the dam, is a relatively congested area with several buildings at low elevations with respect to the river.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - At the time of inspection on May 6, 1980, water was flowing through the penstocks for power generation and the water level in the reservoir had been drawn down approximately 8 inches below spillway elevation, providing an opportunity to view the downstream spillway face as shown in Photos 1, 2 and 3. Heavy showers during the night produced a significant increase in river flow such that during continued inspection on May 7 and 8 the reservoir level was about 3 inches above the 30 inch high flashboards. The weather was cloudy and mild on May 6, cooler with showers on May 7, clearing on May 8. The general condition of this dam is fair.

b. Dam - The dam is a concrete gravity section founded on bedrock as shown in the panoramic view of the downstream face - Photos 1, 2, and 3. An intake control structure and gate house is located on the left abutment as shown in Photo 3. The structure houses a mechanically cleaned trash rack and control gates for two 6 foot diameter penstocks which convey water to the power plant approximately 175 yards downstream of the dam as shown in Photo 4. The trash rack cleaner is electrically powered; the gate operators are manual rack and pinion type. This equipment appears in good condition and is reported operable. The wood frame gate house is in good condition; the electrical system is antiquated and in fair condition. Concrete components of the dam appear in good condition.

Efflorescence and minor spalling, visible in Photo 3, were noted on the downstream face of the intake control structure, and a hairline crack was noted on the upstream face of the left abutment wall at the corner near the center of Photo 7. Photo 5 shows the downstream contact of the concrete dam and the right abutment bedrock. The minor leakage visible on the lower surface of the concrete is clear and occurs at points where an interior construction joint drainage system terminates. The drainage system was installed behind a new concrete facing placed on the existing dam in 1948.

Photo 6 shows the downstream contact of the concrete dam and the left abutment. The staining visible at the bedrock contact is believed to have come from a crack in the dam facing and not from water flowing along the base of the dam. At the time of inspection no water was flowing along the contact.

c. Appurtenant Structures

Spillway

The spillway is an integral part of the main dam as shown in Photos 1, 2 and 3. The spillway section extends from the right abutment to a point about 40 feet right of the control structure, a distance of 186 feet along the dam crest. Spillway concrete appears in good condition with no evidence of cracking or spalling, and only minor erosion. Thirty inch high flashboards, in place at the time of inspection, are removed in the fall to prevent ice and debris damage. The flashboard supports are on 30 inch centers installed in openings intended for flashboard attachment.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - The available data consists of two plans "Village of Hardwick, Vermont, Repairs to Pottersville Dam", Charles T. Main, Inc., Boston, Massachusetts, November 15, 1945, Sheets 1341-11 and 1341-12.

b. Design Features - The drawings, computations and inspection reports indicate the design features stated in Section 1.

c. Design Data - Design data consists of information on the drawings by Charles T. Main, Inc. as listed in "Existing Plans".

2.2 CONSTRUCTION

a. Available Data - Information as contained in any plans, drawings, or specifications previously listed in "Design Data" or Appendix B.

b. Construction Considerations - Since the only available plans are for repairs rather than original design there was no practical means to ascertain any construction changes.

2.3 OPERATION

Pond level observations are made as needed, in order to coordinate the power generation with the available water supply. When ice conditions are not present, flashboards are used to increase the reservoir pool.

2.4 EVALUATION

a. Availability - Existing data was provided by the Village of Hardwick (the owner) who also made the operations available for visual inspection.

b. Adequacy - Detailed hydrologic/hydraulic data were not available. Design data and field measurements were utilized in conjunction with New England Division - Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" to perform the computations of outflow capacity.

The detailed engineering data required to perform an in-depth stability analysis of the dam was not available. The final assessment of the dam, therefore, must be based primarily on visual inspection, performance history, and spillway capacity computations.

c. Validity - A comparison of records, data, and visual observations reveals no significant discrepancies between available plans and as-built dimensions.

6.	Downstream channel:	moderately steep, bedrock exposed
7.	General:	N/A

j. Regulating Outlets

1.	Invert:	728.0
2.	Size:	6 foot diameter
3.	Description:	steel lined concrete sluiceway
4.	Control Mechanism:	manually operated gear reducer
5.	Other:	two 6 foot diameter steel penstocks

4.	Top of dam	615± acre-ft
5.	Test flood pool	1150± acre-ft

f. Reservoir Surface

1.	Normal pool	12± acres
2.	Flood control pool	N/A
3.	Spillway crest	12± acres
4.	Test flood pool	180± acres
5.	Top of dam	80± acres

g. Dam

		Dam	Dike
1.	Type:	concrete gravity	concrete
2.	Length:	384 ft	125 ft
3.	Height:	51.87 ft	16 ft
4.	Top Width:	5 ft	3 ft
5.	Side Slopes:	N/A	N/A
6.	Zoning:	N/A	N/A
7.	Impervious Core:	N/A	N/A
8.	Cutoff:	N/A	N/A
9.	Grout curtain:	N/A	N/A
10.	Other:	N/A	N/A

h. Diversion and Regulating Tunnel N/A

i. Spillway

1.	Type:	ogee concrete
2.	Length of Weir:	186 feet
3.	Crest elevation w/o flashboards: w/flashboards:	762.0 764.5
4.	Gates:	N/A
5.	Upstream channel:	Wolcott Dam impoundment

7.	Total spillway capacity at test flood el. 781.5	60862 cfs
8.	Total project discharge at top of dam el. 770.87	20250± cfs
9.	Total project discharge at test flood el. 781.5	114800 cfs

c. Elevation (Feet NGVD)

1.	Streambed at toe of dam	719.0
2.	Bottom of cutoff	N/A
3.	Maximum tailwater	N/A
4.	Recreation pool	N/A
5.	Full flood control pool	N/A
6.	Spillway crest (ungated)	762.0 w/o flashboards 764.5 w/flashboards
7.	Design surcharge	N/A
8.	Top of dam	770.87
9.	Test flood surcharge	781.5

d. Reservoir

1.	Normal pool	2500± ft
2.	Flood control pool	N/A
3.	Spillway crest pool	2500± ft
4.	Top of dam	11000± ft
5.	Test flood pool	21000± ft

e. Storage

1.	Normal pool	258± acre-ft
2.	Flood control pool	N/A
3.	Spillway crest pool w/o flashboards w/flashboards	258± acre-ft 340± acre-ft

h. Design and Construction History - The following information is believed to be accurate based upon plans and correspondence available and from conversations with persons familiar with the history of the dam. Information pertaining to the original construction, believed to be about 1920, was not available. The powerhouse reportedly incurred extensive flood damage in 1927 and was repaired at that time. The power station was rebuilt and existing generation equipment installed in 1937. Repairs to the dam were designed in 1945 by Charles T. Main, Inc. and performed in 1948 by O. W. Miller for the Village of Hardwick.

i. Normal Operation Procedures - Flashboards are installed to a level of 2.5 feet above the spillway crest when ice conditions are unlikely. Pond level is regulated as necessary to coordinate power generation with available flow. At times of low flow, power generation is curtailed in the evening to restore the pond level. An operator is on duty when the station is operating.

1.3 PERTINENT DATA

a. Drainage Area - 134.7 square miles of moderately steep, relatively undeveloped terrain which is approximately 40% open and 60% wooded.

b. Discharge at Dam Site - Discharge is from over the spillway and through the 72 inch low level outlet and two 72 inch penstocks. Elevations are referenced to NGVD datum.

1.	Outlet works	
	One 72" steel lined pipe @ invert el. 728.0	1400± cfs
	Two 72" steel penstocks @ invert el. Unknown	Unknown
2.	Maximum known flood at dam site	N/A
3.	Ungated spillway capacity at top of dam el. 770.87 (w/o flashboards)	18672 cfs
4.	Ungated spillway capacity at test flood el. 781.5	60862 cfs
5.	Gated spillway capacity at normal pool el. 762.0 (w/o flashboards)	N/A
6.	Gated spillway capacity at test flood el. 781.5	N/A

The two spillway sections have crest elevations of approximately 762.0, a maximum of 43 feet in height above the streambed. Two and one-half feet of flashboard increase the spillway elevation to 764.5. The spillways have an ogee crest with a downstream slope of 7-5/8 horizontal to 12 vertical.

The central sluiceway pier, also with downstream slope of 7-5/8 horizontal to 12 vertical, has a breadth of 12 feet and a crest length of approximately 13.3 feet at elevation 772.0. A 6 foot diameter steel lined sluiceway, approximately 34 feet in length, runs through the pier at invert elevation 728.0. The manually operated gate control mechanism is accessed via a footbridge from the left abutment section.

The left abutment section, 174 feet in length, has a crest elevation of 770.87 and houses the intake structure consisting of two 6 foot diameter steel penstocks with trashracks and gates enclosed in a wooden gate house. A downstream training wall extends from the right end of this abutment.

Approximately 150 yards upstream of the dam site is a reinforced concrete dike on the right of the pool. The 16 foot high dike is approximately 125 feet long with a 3 foot broad crest at approximate elevation 770.2.

Elevations are referenced to NGVD datum.

No instrumentation exists at this dam site.

c. Size Classification - INTERMEDIATE - The dam impounds approximately 615 acre-feet of water with the pond level at the top of the dam, which at elevation 770.87 is 51.87 feet above the streambed elevation. Because the height is between 40 and 100 feet, the dam is classified as intermediate in size according to the Recommended Guidelines.

d. Hazard Classification - HIGH - If the dam were to be breached, there is potential for considerable property damage and loss of more than a few lives. Ten to fifteen houses in the Town of Wolcott would be flooded with depths up to 4.5 feet above sill elevation. Failure flows would also damage the power plant 175 yards downstream of the dam, the pair of highway bridges on Vermont Route 15, the Lamoille Valley Railroad bridge and the town road bridge in Wolcott.

e. Ownership - Village of Hardwick
Hardwick, Vermont 05843
(802) 472-5201

f. Operator - Mr. William Fee, Superintendent
Village of Hardwick Electrical Department
Church Street
Hardwick, Vermont 05843
(802) 472-5201

g. Purpose of Dam - The dam is used for power generation utilizing one vertical Smith-Kaplan turbine of 800 KW capacity, normally producing 600 KW at a 2400 V line voltage.

PHASE I INSPECTION REPORT

WOLCOTT DAM

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James W. Sewall Company has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to James W. Sewall Company under a letter of April 2, 1980 from William E. Hodgson, Jr. Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

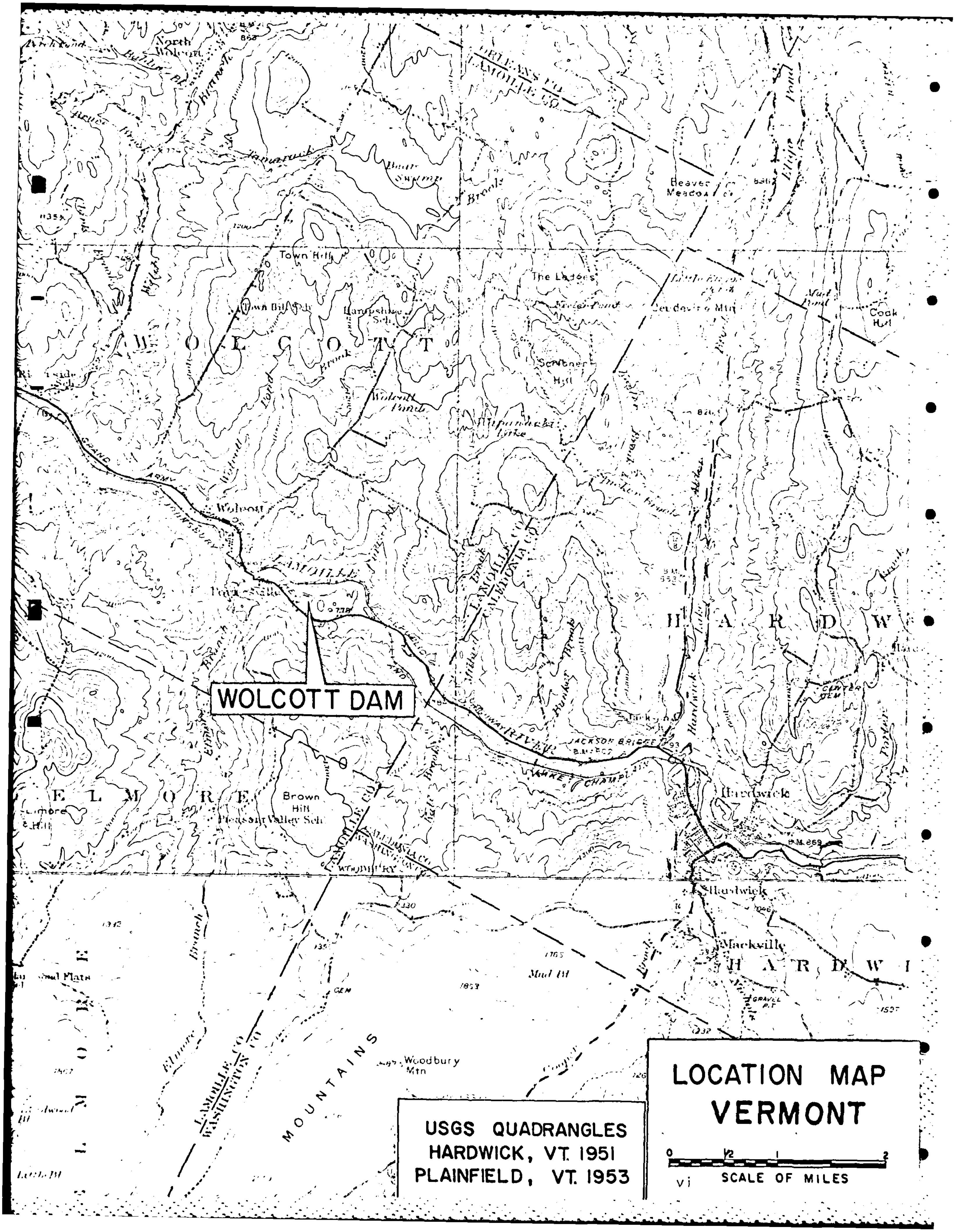
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on the Lamoille River in the Village of Pottersville, Town of Wolcott, County of Lamoille, State of Vermont. The dam is shown on the Hardwick USGS Quadrangle Map (15' series) having coordinates latitude N 44° 32.2' and longitude W 72° 26.7'. The dam is popularly called Pottersville Dam.

b. Description of Dam and Appurtenances - The dam, originally constructed about 1920 and refaced in 1948, is a reinforced concrete gravity structure 51.87 feet high, built on ledge rock and having a total length of approximately 384 feet. This includes a 120 foot long spillway section on the right side of the dam, a central sluiceway pier with outlet works, a 66 foot long spillway section to the left of the sluiceway pier, and an abutment section with intake structure for power generation on the left side of the dam.


WOLCOTT DAM
North Wolcott
Tamarack
Beaver Meadow
Town Hill
The Ledges
Cook Hill
W O L C O T T
Schoner Hill
Wolcott Pond
Wolcott
LAMOILLE
LAMOILLE CO
CALEDONIA CO
ORLEANS CO
H A R D W
Jackson Sch
JACKSON BRIDGE
RIVER
LAKE CHAMPLAIN
Hardwick
E L M O R E
Brown Hill
Pleasant Valley Sch
Elmore
Mackville
H A R D W I
Mud Hill
Woodbury Mtn
MOUNTAINS
LAMOILLE CO
WASHINGTON CO
CENTER CEM
GRAVEL PIT
0
1/2
1
2

LOCATION MAP VERMONT

SCALE OF MILES

USGS QUADRANGLES
HARDWICK, VT. 1951
PLAINFIELD, VT. 1953

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Wolcott Dam - VT 00179

Wolcott, Vermont

April 22, 1980

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5.3 Experience Data 5-1

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6. EVALUATION OF STRUCTURAL STABILITY 6-1

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7. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES 7-1

7.1 Dam Assessment 7-1

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b. Adequacy of Information 7-1
c. Urgency 7-1

7.2 Recommendations 7-1

7.3 Remedial Measures 7-1

7.4 Alternatives 7-2

APPENDIX

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APPENDIX C - DETAIL PHOTOGRAPHS C-1

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APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS E-1

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The project is basically a run-of-the-river dam used for power generation, with impoundment surface area changing dramatically with water level.

The tributary watershed consists of 134.7 square miles of moderately steep terrain which is approximately 60% wooded and 40% open. Contained within this drainage area are several small lakes, including Hardwick Lake, Caspian Lake, Eligo Pond, Nichols Pond, Long Pond, East Long Pond and Flagg Pond. The total surface area of these lakes is less than 2% of the entire watershed area, thus their storage effect on the peak inflow to the Wolcott Dam impoundment was deemed negligible.

Wolcott Dam is a concrete gravity structure equipped 186 feet of ogee crest spillway. The spillway will pass approximately 16% of the project Test Flood with the dam overtopped by 10.6 feet.

5.2 DESIGN DATA

No design data are known to exist for the project.

5.3 EXPERIENCE DATA

A flood in 1927 reportedly caused extensive damage to the power house. No other information on serious problem situations arising at the dam was found and it does not appear the dam has been overtopped.

5.4 TEST FLOOD ANALYSIS

The Test Flood for this high hazard, intermediate size dam is equivalent to the Probable Maximum Flood (PMF). Based upon the "Rolling" guide curve from the "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978, peak inflow to Wolcott Dam flowage is 117,863 cfs. Assuming the reservoir to be initially at spillway crest elevation (762 NGVD) routed Test Flood outflow is 114,800 cfs with the dam overtopped by 10.6 feet. Based upon our hydraulics computations, the spillway capacity is approximately 16% of the routed Test Flood outflow at the top of the dam.

5.5 DAM FAILURE ANALYSIS

The impact of dam failure was assessed utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs".

With the reservoir water surface elevation initially at the top of the dam (el. 770.87 NGVD), the peak failure outflow would be 44,200 cfs causing a rise in stage in the Town of Pottersville of 3.5 feet and a rise in stage in the Town of Wolcott of 3.3 feet. It appears that the pre-failure flow would cause the most significant damage with a maximum depth of 9 feet at the houses in Wolcott.

The preceding analysis indicated little additional stage or hazard due to dam failure under full spillway pre-failure conditions. As the failure flow was significant an analysis with the reservoir water surface elevation initially at the spillway crest (el. 762 NGVD) was undertaken to establish the "low flow" failure hazard. The peak failure outflow under this condition would be 22,800 cfs. The pre-failure flow would remain within the bounds of the stream bed while the routed failure flood would inundate a large area outside of the stream bed up to a depth of 4.5 feet. The rapid rise in flood stage would severely damage the power plant 175 yards downstream of the dam, destroy the pair of Route 15 highway bridges, the Lamoille Valley Railroad crossing, and the town road crossing in Wolcott. The Town of Wolcott is located on a relatively level flood plain and the failure flood could damage 10-15 homes with a maximum water level of 4.5 above sill elevation. There is potential for the loss of more than a few lives in the Town of Wolcott. Based on this analysis, Wolcott Dam has been classified as a "High Hazard" dam.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION

The visual inspection did not disclose any immediate stability problems. Seepage and spalling noted at the dam and the dike are judged to be minor in nature.

6.2 DESIGN AND CONSTRUCTION DATA

No original design and construction data are available for the dam. However, there are drawings for repairs which show plans and sections of the dam and indicate that the dam rests on bedrock.

6.3 POST-CONSTRUCTION CHANGES

Drawings indicate that a concrete facing was placed on the upstream and downstream face of the dam. Records indicate this work was performed in 1948. The concrete facing is 12 inches thick on the downstream face of the spillway and 8 inches thick on the upstream face of the dam and downstream face of the sluiceway pier. This concrete facing is tied to the existing concrete with steel dowels 3 feet on center in both directions. A construction joint drainage system consisting of 6 inch diameter tile drains was installed between the new facing and the existing dam. Openings for flashboard attachment were installed at the spillway crest. It is not known what provision, if any, was made in the original design for the additional hydrostatic head which flashboards impose.

6.4 SEISMIC STABILITY

The dam is located in Seismic Zone 2 and in accordance with the recommended Phase I guidelines, does not warrant seismic investigation.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection, the dam is judged to be in fair condition. This assessment is predicated primarily upon concerns regarding spillway hydraulic capacity and effect of flashboards on dam stability. Structural and mechanical condition is good.

b. Adequacy of Information - Due to the lack of design and construction data for this dam, the assessment of safety is based solely on the visual inspection.

c. Urgency - The recommendations and remedial measures presented below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

7.2 RECOMMENDATIONS

The owner should engage a qualified registered engineer to undertake further investigations as follow:

a. Assess significance of the seepage occurring on the downstream faces of the dam and the dike and design remedial measures if needed.

b. Determine the effect of the currently-used flashboard system on dam stability.

c. Perform a detailed hydraulic and hydrologic study to further assess the need for and the means to increase the project discharge capacity.

d. The moss, trees, and debris on the face and within 10 feet of the toe of the dike should be removed by the owner.

The owner should implement all recommendations by the engineer.

7.3 REMEDIAL MEASURES

a. The eroded concrete on the sluice gate control enclosure should be repaired by the owner.

b. The crack at the bend in the left abutment wall should be repaired by the owner.

c. The spalled concrete on the face of the dike should be removed and the areas patched by the owner.

d. Areas of seepage at the base of the dam and the dike should be monitored monthly by the owner, and technical assistance sought upon any major quantity increase.

e. A program of biennial technical inspection, with repairs as necessary should be instituted by the owner.

f. A formal downstream warning system to be implemented in the event of flood flow or imminent dam failure conditions should be developed by the owner.

7.4 ALTERNATIVES

This study has identified no practical alternative to the above recommendations.

APPENDIX A

VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Wolcott Dam

DATE May 6, 7, 8, 1980

TIME 3:00, 10:00

WEATHER Cloudy, mild

W.S. ELEV. ______ U.S. ______ DN.S.

PARTY:

1. Stephen D. Murray SDM
2. Rodney L. Hanscom RLH
3. Charles A. Heney CAH
4. Daniel P. LaGatta DPL
5. Peter Barraico
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Concrete Dam	SDM, RLH, CAH, DPL	
2.	Concrete Dike	SDM, RLH, CAH	
3.	Gate House	SDM, RLH, CAH	
4.	Sluice Gate and Conduit	SDM, RLH, CAH	
5.	Outlet Channel	SDM, RLH, CAH, DPL	
6.	Spillway Weir and Discharge Channel	SDM, RLH, CAH, DPL	
7.	Service Bridge	SDM, RLH, CAH	
8.			
9.			
10.			

PROJECT Wolcott Dam
DATE May 6, 7, 8, 1980
PROJECT FEATURE Concrete Dam
NAME SDM, RLH,
DISCIPLINE James W. Sewall Co.
Geotechnical Engineers Inc.
NAME CAH, DPL

AREA EVALUATED	CONDITION
DAM EMBANKMENT	Concrete dam founded on bedrock Bedrock is exposed along entire length of dam
Crest Elevation 770.87	
Current Pool Elevation May 6 761 May 7 765	
Maximum Impoundment to Date	
Surface Cracks	Vertical crack at bend of abutment
Pavement Condition	Good
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Conditions at abutment contact are good. Slight leakage at interface at outcrop along left abutment and at toe.
Indications of Movement of Structural Items on Slopes	
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	N.A.
Piping or Boils	N.A.
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None
Vegetation	N.A.

PERIODIC INSPECTION CHECKLIST

PROJECT Wolcott Dam
DATE May 6, 7, 8, 1980

PROJECT FEATURE Concrete dike
NAME SDM, RLH

DISCIPLINE James W. Sewall Co.
Geotechnical Engineers inc.
NAME CAH, DPL

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	Concrete dike 150 yards above dam, right side
Crest Elevation	770
Current Pool Elevation	May 8 765
Maximum Impoundment to Date	
Surface Cracks	Minor
Pavement Condition	Minor efflorescence, considerable spalling
Movement or Settlement of Crest	No
Lateral Movement	No
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	No
Trespassing on Slopes	No
Sloughing or Erosion of Slopes or Abutments	No
Rock Slope Protection - Riprap Failures	N.A.
Unusual Movement or Cracking at or Near Toes	No
Unusual Embankment or Downstream Seepage	Very minor seepage at base of wall, downstream end
Piping or Boils	Slight seepage from 2" plugged pipe in wall
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None
Vegetation	Moss and several small trees growing on dike

PROJECT Wolcott Dam

DATE May 6, 7, 8, 1980

PROJECT FEATURE

NAME SDM, RLH

DISCIPLINE James W. Sewall Co.
Geotechnical Engineers Inc.

NAME CAH, DPL

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	No approach channel Penstocks built into dam
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PROJECT Wolcott Dam

DATE May 6, 7, 8, 1980

PROJECT FEATURE Gate House

NAME SDM, RLH

DISCIPLINE James W. Sewall Co.
Geotechnical Engineers Inc.

NAME CAH, DPL

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER Gate House	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Minor spalling downstream face
Visible Reinforcing	None
Rusting or Staining of Concrete	Minor
Any Seepage or Efflorescence	Minor efflorescence
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	No
Cracks	None observed
Rusting or Corrosion of Steel	Minor rusting
b. Mechanical and Electrical	
Air Vents	N. A.
Float Wells	N. A.
Crane Hoist	For trasn rake rake, good condition
Elevator	N. A.
Hydraulic System	N. A.
Service Gates	For penstock gates, good condition
Emergency Gates	N. A.
Lightning Protection System	N. A.
Emergency Power System	N. A.
Wiring and Lighting System	Fair condition

PROJECT Wolcott Dam

DATE May 6, 7, 8, 1980

PROJECT FEATURE Sluice Gate and Conduit

NAME SDM, RLH

DISCIPLINE James W. Sewall Co.
Geotechnical Engineers Inc.

NAME CAH, DPL

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Good
Rust or Staining on Concrete	Rust stains below conduit outlet
Spalling	None
Erosion or Cavitation	Moderate erosion of sluice control enclosure at water line
Cracking	
Alignment of Monoliths	N.A.
Alignment of Joints	No misalignment
Numbering of Monoliths	N.A.

PROJECT Wolcott Dam

PROJECT FEATURE Outlet Channel

DISCIPLINE James W. Sewall Co.
Geotechnical Engineers Inc.

DATE May 6, 7, 8, 1980

NAME SDM, RLH

NAME CAH, DPL

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Penstocks are main outlet Low-level outlet is a conduit through base of dam.
General Condition of Concrete	
Rust or Staining	N.A.
Spalling	N.A.
Erosion or Cavitation	N.A.
Visible Reinforcing	N.A.
Any Seepage or Efflorescence	N.A.
Condition at Joints	N.A.
Drain holes	N.A.
Channel	
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECKLIST

ROJECT Wolcott Dam — DATE May 6, 7, 8, 1980

ROJECT FEATURE Spillway Weir and Discharge Channel — NAME SJM, RLH

ISCIPLINE James W. Sewall Co. — NAME CAH, DPL
Geotechnical Engineers Inc.

AREA EVALUATED	CONDITION
UTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
. Approach Channel	No approach channel. Spillway is integral with dam
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	small rust stain to right of conduit outlet
Spalling	No
Any Visible Reinforcing	No
Any Seepage or Efflorescence	Minor efflorescence
Drain Holes	None visible
. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Bedrock - clear
Other Obstructions	None

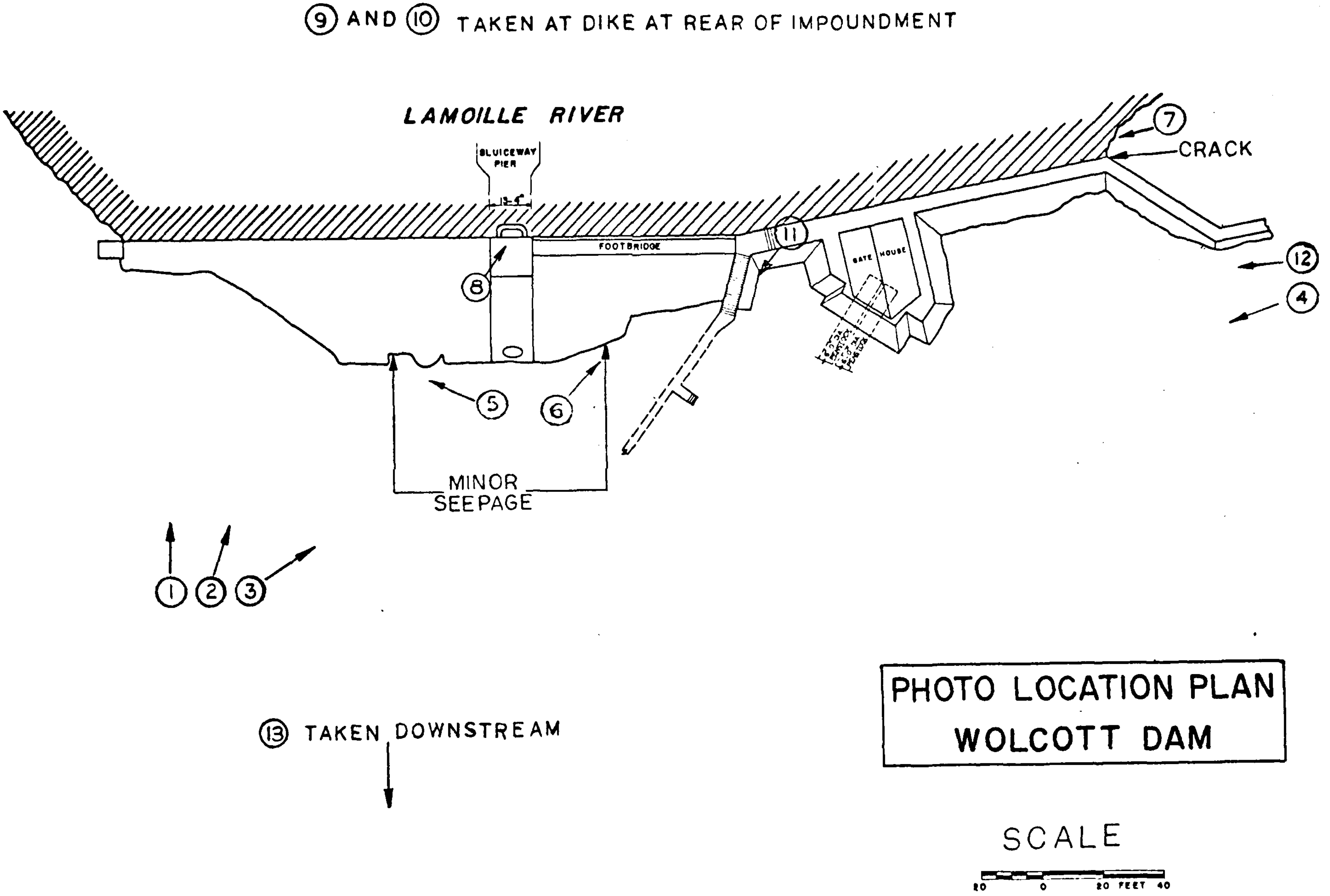

⑨ AND ⑩ TAKEN AT DIKE AT REAR OF IMPOUNDMENT
LAMOILLE RIVER
SLUICEWAY PIER
13'-6"
FOOTBRIDGE
GATE HOUSE
⑦
CRACK
⑪
⑫
④
⑧
⑤
⑥
MINOR SEEPAGE
①
②
③
⑬ TAKEN DOWNSTREAM
SCALE
20
0
20 FEET 40

PHOTO LOCATION PLAN
WOLCOTT DAM

APPENDIX C

DETAIL PHOTOGRAPHS

3-11-80
APB

WOLCOTT DAM VT7420 16-129

Sh = hh = 773
−719
54'

class 2 possible

$\ell = 8 + 120 + 13 + 66 + 120 + 42 + 15$
$= 384'$

Spillway = 120 + 66 = 186'

$Q = (3.8)(186)(9)^{1.5} = 19,084$ 19,000 cfs

SA = 200 × 2500 ← 308 Report length of pool
43560
12 A

Vol. @ NWL = 12 × 46 × .4 = 221 AF 200

assume FB already in → 7 × 20 A 140
360 AF 350

SHH SA = 6 A Vol = 3×10^6 / 43560 = 69 AF
assume 1 2.5' of FB

too small

D/A road = .3 mi² $\frac{(.3)(5280)(200)}{43,560} = 7\ A$

w/FB
7 × 48 × .4 = 134 AF

[illegible]

INSPECTION REPORT
ON
Wolcott Dam

1. Date of inspection May 9, 1953   2. Water conditions Spilling over Part of Crest

GENERAL DATA:

3. Location of dam Lamoille River, town of Wolcott.

4. Owner and operator Village of Hardwick

5. Characteristic features of dam Concrete gravity dam about 50 ft. high, rebuilt in 1948.

6. Other related data Contained in writer's initial report on structure.

OBSERVATIONS:

7. Condition of structure No appreciable change

8. Condition of equipment Satisfactory

9. Operation Satisfactory

10. Maintenance Satisfactory

REMARKS:

Dam remains in a good condition.

Inspected by

Conclusions:

From the inspection made of Wolcott Dam, the writer concludes that this structure, as repaired last year, is in a sound condition. It can safely accommodate floods equal in size to any previous recorded flood.

Stephen H. Haybrook
STEPHEN H. HAYBROOK
HYDRAULIC ENGINEER

Public Service Commission
Montpelier, Vermont
September 8, 1949

REPORT No. 71

corresponding base width of about 40 feet. The spillway is shaped with conventional curved crest and discharge face. Flashboards are built up to a level 2.5 feet above the spillway crest.

An intake is located in the abutment section and adjacent to the spillway. Trashracks and gates are enclosed in a wooden building. From here the flow is diverted through two 6-foot diameter steel penstock to the power house further downstream.

A 6-foot diameter sluiceway is also provided in a pier through the spillway section at its maximum depth. Access to the sluiceway is provided by a footbridge from the left abutment section.

Details of the dam are indicated in the attached drawings.

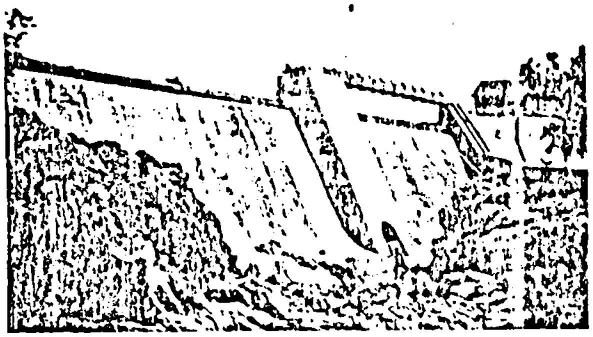
Condition of the Dam:

This dam was examined by the writer on June 15, 1949 and appeared in excellent condition. As indicated by the photograph, the dam has undergone a refacing operation, which was completed in November, 1948. The work was done under the supervision of the Chas. T. Main, Inc. engineering firm in accordance with the drawings attached hereto.

The repairs accomplished last year consisted of the chipping off of the old, deteriorated concrete on exposed surfaces and the replacing it with a thickness ~~[illegible]~~ of at least 8 inches of new concrete bonded to the old concrete core with reinforcement mesh and dowels. The method used is an accepted procedure in such repair jobs and, from appearances, the work was soundly executed.

Some leakage was observed at the base of the intake structure. Indications were that this leakage originates elsewhere along the left abutment section, probably at the joint between the dam and the foundation. However, the quantity of leakage is not sufficient to cause any concern.

REPORT ON WOLCOTT DAM



Wolcott Dam (Spillway Section)

Wolcott Dam is one of the developments on the Lamoille River belonging to the Village of Hardwick. It is located in the Village of Pottersville in the Town of Wolcott, Vermont and is sometimes called Pottersville Dam. It serves as a diversion structure for a hydroelectric power plant.

The drainage area to the dam is about 130 square miles. At full pond level, the reservoir has a surface area of about 6 acres and impounds about 3,000,000 cubic feet of water.

Description:

Wolcott Dam is a solid, gravity-type, concrete structure [illegible] on ledge rock. It has a total length of about 390 feet, including a spillway section in the main river channel as the north half of the dam. The net spillway length is 186 feet with the crest 9 feet below the top of the dam. In cross-section, the spillway has a maximum depth of 50 feet and

STATE OF VERMONT
PUBLIC SERVICE COMMISSION

Electric-Utility Dams

OCT 16 [illegible]

1. Name of Dam: Wolcott

2. Owner of Dam: Village of Hardwick

3. Located in What Town: Wolcott

4. Is the Dam in Use: yes

5. Name of Lake, Pond, River, Brook, Creek, Etc., on Which Located:
Lamoille River

6. Material Used in Construction of the Dam:
Concrete

7. Purpose for Which Dam is Used:
Power generation

8. Is Dam Attended or Unattended:
Yes

9. Approximate Surface Area of the Body of Water Impounded by Dam:
acre

10. Approximate Volume of Water, in Cubic Feet, Impounded by Dam when in full Use:
$\frac{3,268,000}{7.5}$ gals = [illegible]

11. Regulations Governing the Operation of the Dam:
none

12. Remarks:

This dam is to be reconditioned next year. Survey work was completed in 1945 , but have been unable to give up use of same until there is more power available from other sources.

Utility: Village of Hardwick

Signed: (Title)

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
10/1/47	St. of Vt. Public Ser. Comm.	G.W. Larrabee, Treas. Village of Hardwick	Information Sheet	B-4
9/8/49	File	Stephen H. Haybrook Hydraulic Engineer Public Ser. Comm.	Detailed Dam Inspec. Report (1 year after dam refacing)	B-5
5/9/53	File	Stephen H. Haybrook Hydraulic Engineer Public Ser. Comm.	Dam Inspection Report	B-8
3/11/80	File	A. P. Barranco Dam Safety Engineer Vt. Dept. of Water Resources	Storage and Spillway Capacity Calculations	B-9

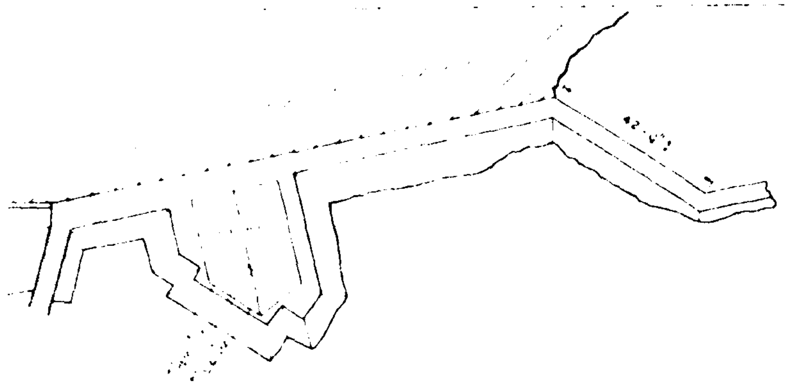
WOLCOTT DAM

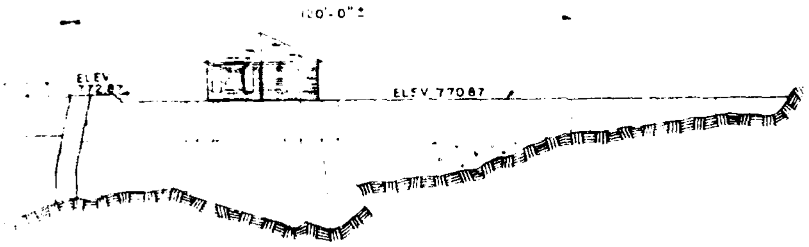
EXISTING PLANS

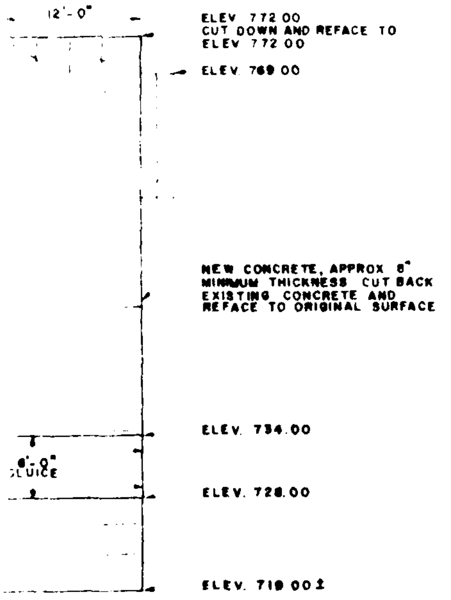
On file with the Village of Hardwick:

"Village of Hardwick, Vermont
Repairs to Pottersville Dam
Charles T. Main, Inc., Architects - Engineers
Boston, Massachusetts
November 15, 1945
5 Sheets - Blueprints

REPRODUCED AT GOVERNMENT EXPENSE




120'-0"±
ELEV 772.87
ELEV 770.87


12'-0"
ELEV. 772.00
CUT DOWN AND REFACE TO
ELEV. 772.00
ELEV. 769.00
NEW CONCRETE, APPROX. 6"
MINIMUM THICKNESS. CUT BACK
EXISTING CONCRETE AND
REFACE TO ORIGINAL SURFACE
ELEV. 734.00
6'-0"
SLUICE
ELEV. 728.00
ELEV. 719.00±

NOTE:
THIS PLAN COMPILED FROM EXISTING PLANS FOR THE DAM RECONSTRUCTION IN 1946, BY CHAS. T. MAIN, INC., ENGINEERS, AND MODIFIED AS OBSERVED IN THE FIELD.

A

EET 16

ARMY ENGINEER DIV, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

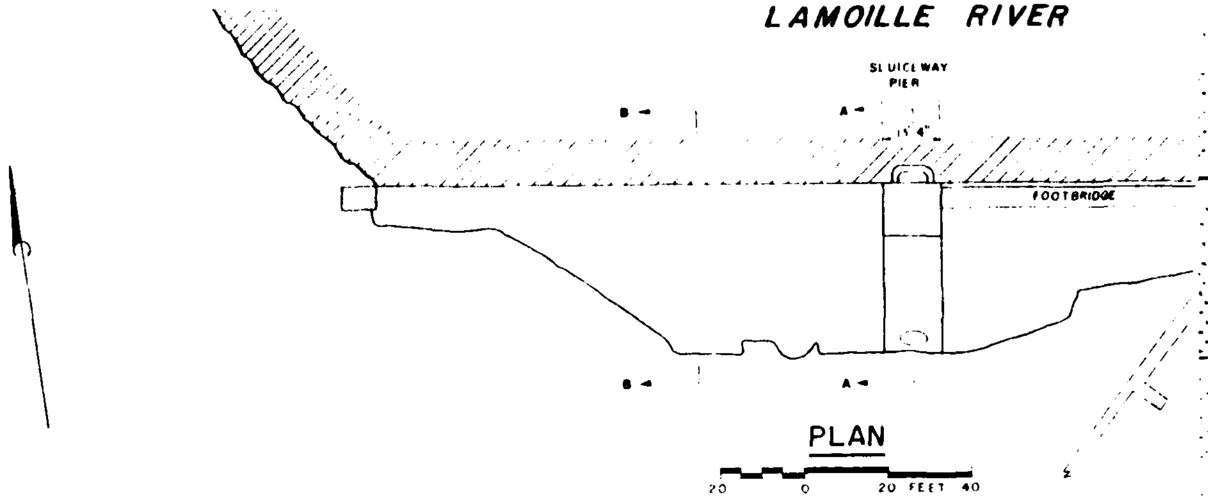
JAMES W SEWALL COMPANY
CONSULTING ENGINEERS

NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

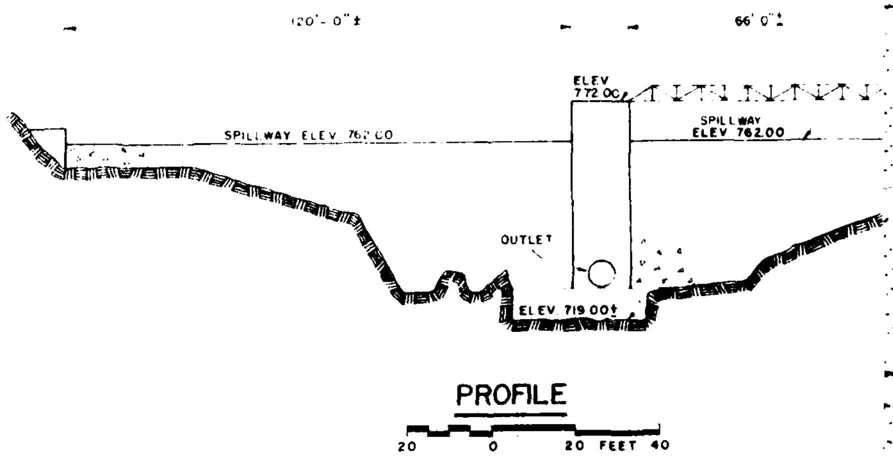
WOLCOTT DAM
WOLCOTT, VT.

REPRODUCED AT GOVERNMENT EXPENSE

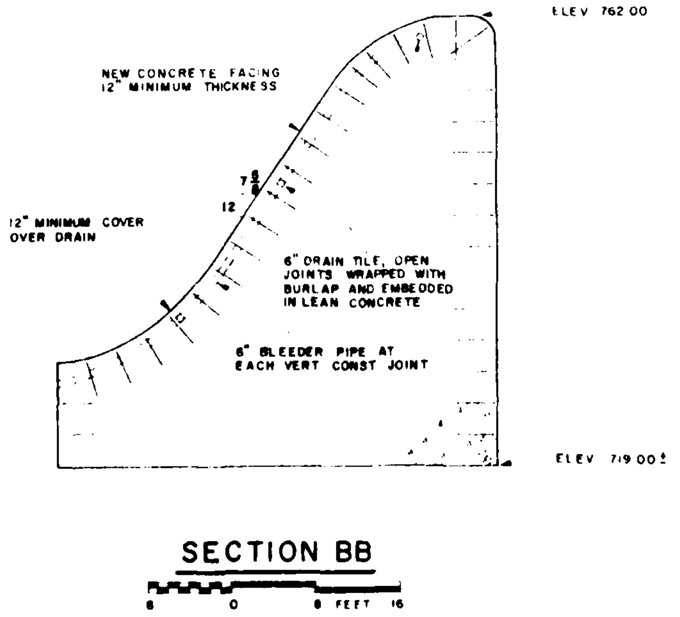
LAMOILLE RIVER


SLUICEWAY PIER
B
A
15'4"
FOOTBRIDGE
B
A
20
0
20 FEET 40

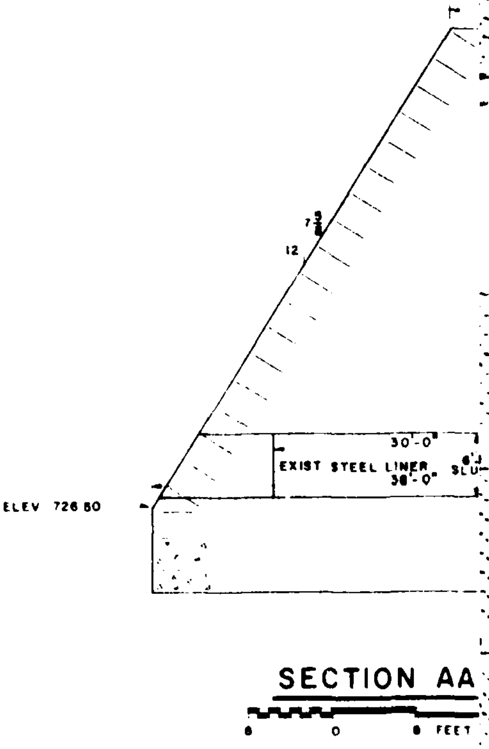
PLAN


120'-0"±
66'0"±
ELEV 772.00
SPILLWAY ELEV 762.00
SPILLWAY ELEV 762.00
OUTLET
ELEV 719.00±
20
0
20 FEET 40

PROFILE


ELEV 762.00
NEW CONCRETE FACING 12" MINIMUM THICKNESS
7½
12
12" MINIMUM COVER OVER DRAIN
6" DRAIN TILE, OPEN JOINTS WRAPPED WITH BURLAP AND EMBEDDED IN LEAN CONCRETE
6" BLEEDER PIPE AT EACH VERT CONST JOINT
ELEV 719.00±
8
0
8 FEET 16

SECTION BB


7½
12
30'-0"
EXIST STEEL LINER
38'-0"
ELEV 726.80
8
0
8 FEET

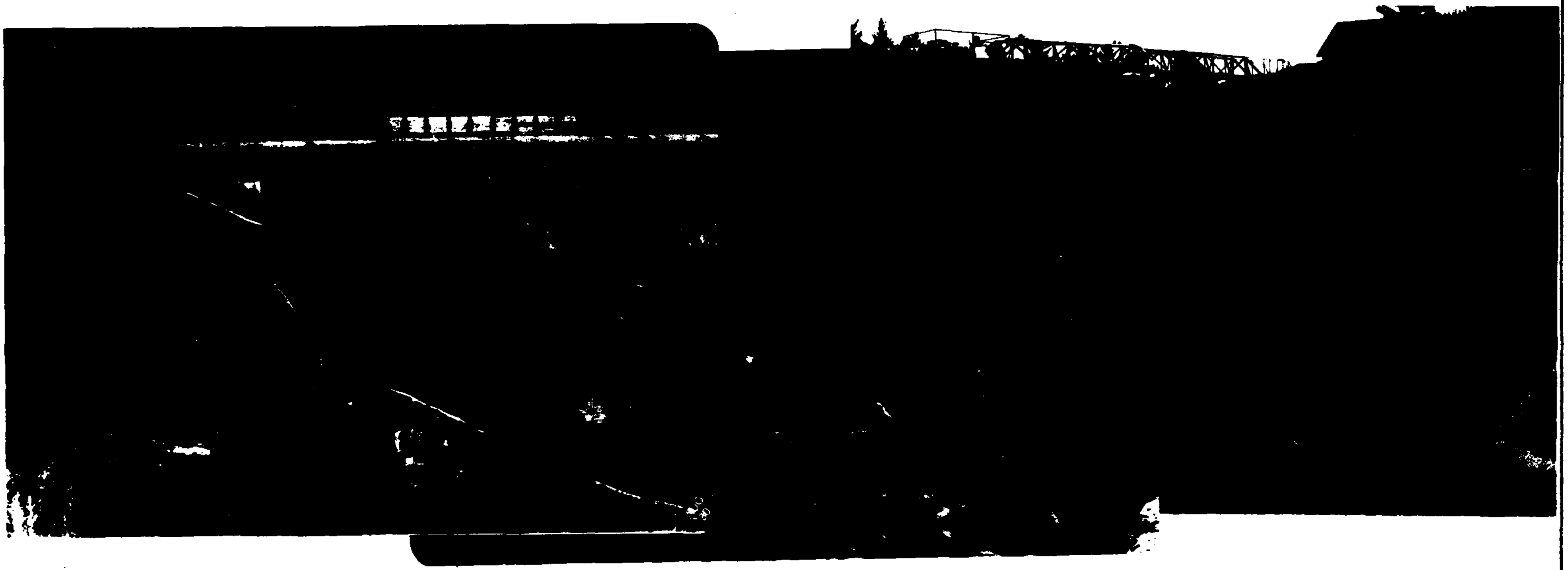
SECTION AA

APPENDIX B

ENGINEERING DATA

PROJECT Wolcott Dam
DATE May 6, 7, 8, 1980
PROJECT FEATURE Service Bridge
NAME SDM, RLH,
DISCIPLINE James W. Sewall Co.
Geotecnnical Engineers Inc.
NAME CAH, DPL

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	Service Bridge goes from abutment to sluiceway pier
a. Super Structure	Moderate amount of rusting
Bearings	Good
Anchor Bolts	Good
Bridge Seat	Good
Longitudinal Members	Good
Underside of Deck	Good
Secondary Bracing	Good
Deck	Good
Drainage System	N.A.
Railings	Good
Expansion Joints	N.A.
Paint	Fair
b. Abutment & Piers	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat & Backwall	Good



(1), (2), and (3) Panorama of Downstream Face

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

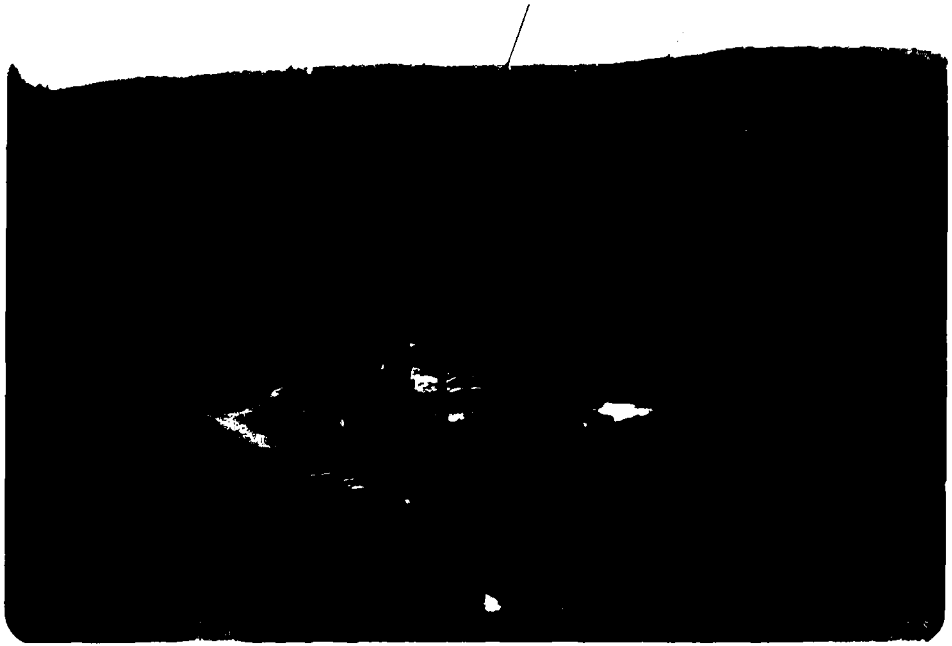
JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Wolcott Dam - VT 00179

Wolcott, Vermont

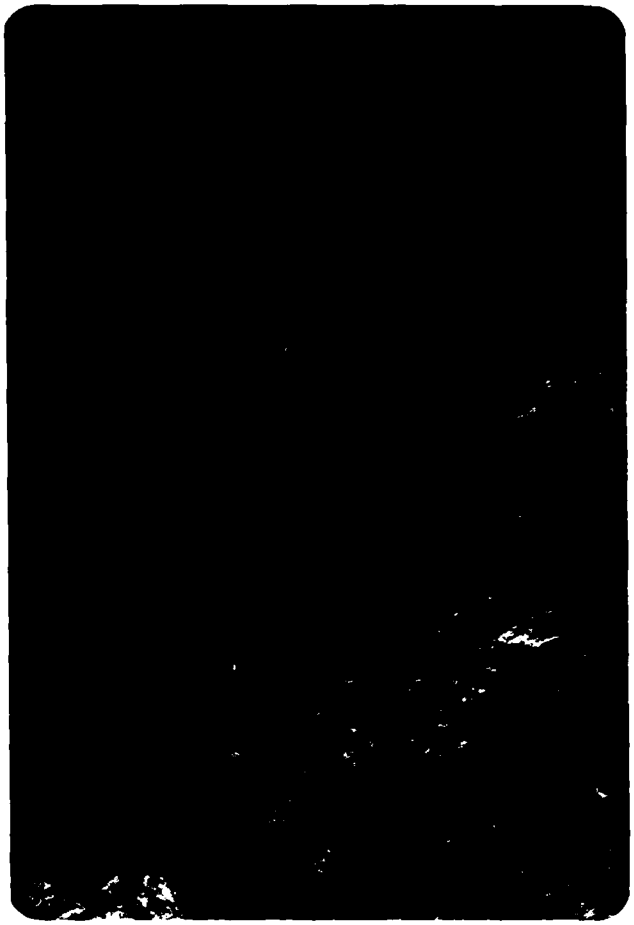
May 6, 1980



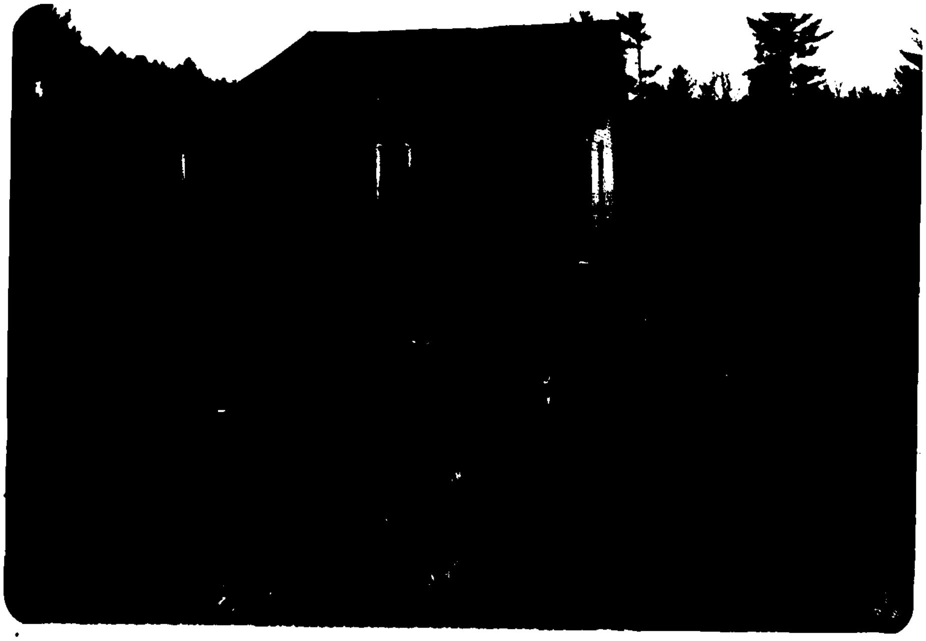
(4) Penstocks, Powerhouse Downstream of Dam - May 6, 1980

(5) Right Abutment Bedrock
May 6, 1980

U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Wolcott Dam Wolcott, Vermont VT 00179 May, 1980
JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE		



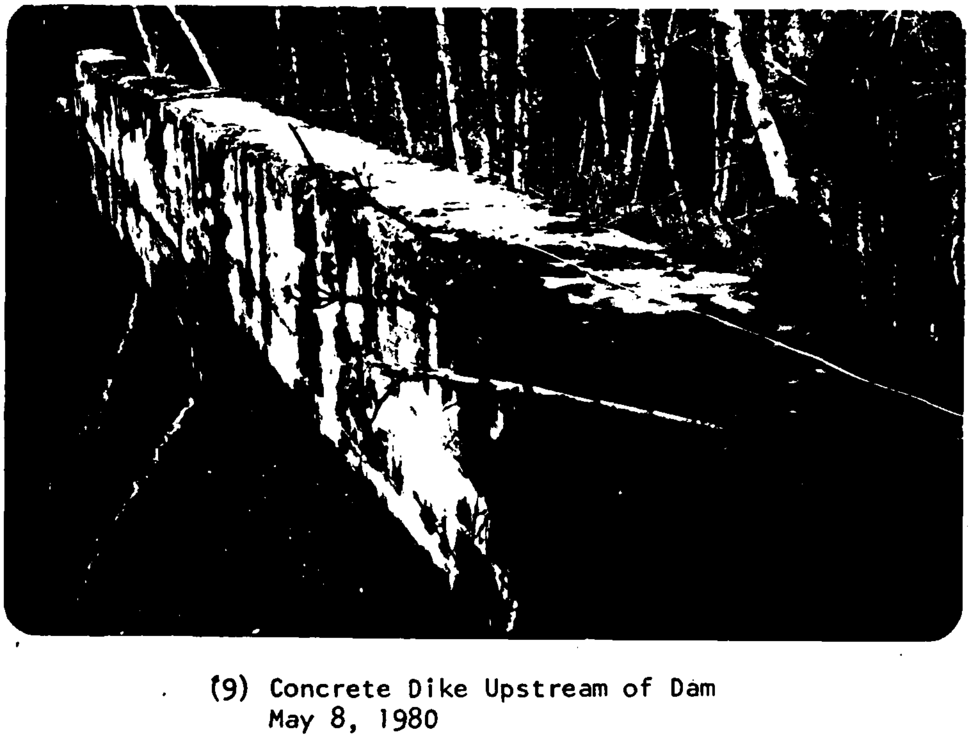
(6) Left Abutment Bedrock
May 6, 1980



(7) Left Abutment, Upstream Face, and Gatehouse - May 6, 1980

U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Wolcott Dam Wolcott, Vermont VT 00179 May, 1980
JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE		C-4

(8) Reservoir Outlet Gate Controls
May 6, 1980



(9) Concrete Dike Upstream of Dam
May 8, 1980

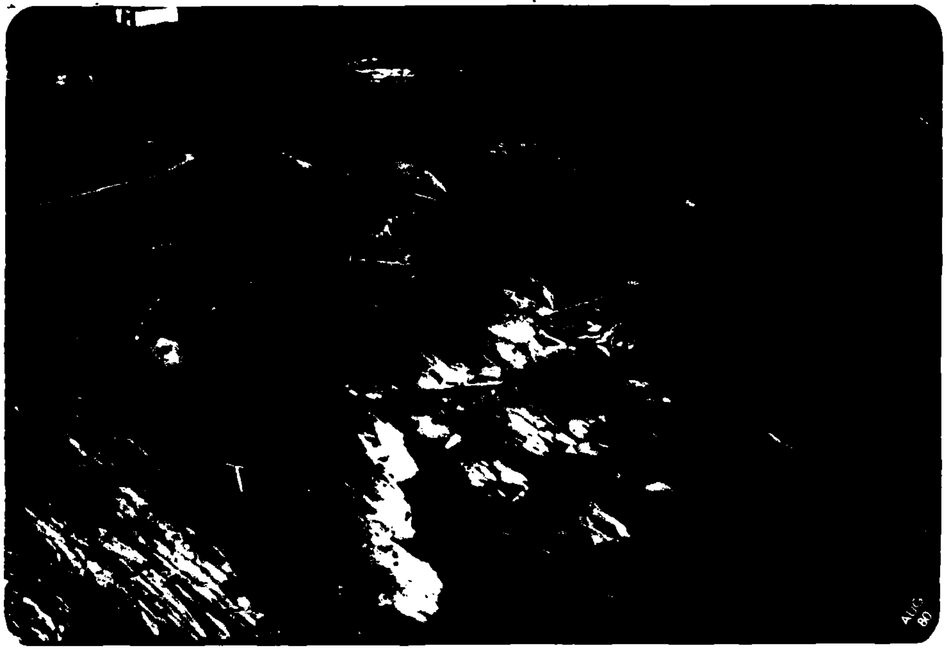
U.S. ARMY ENGINEER DIV, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Wolcott Dam
Wolcott, Vermont
VT 00179
May, 1980

(10) Face of Concrete Dike (Metal Scrap in Foreground)
May 8, 1980



(11) Downstream Channel, Powerhouse in Left Background - May 6, 1980

U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Wolcott Dam Wolcott, Vermont VT 00179 May, 1980
JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE		C-6

(12) Downstream Channel and Face of Dam After Heavy Showers
May 7, 1980

(13) Vermont Route 15 Bridges Downstream of Dam - May 8, 1980

U.S. ARMY ENGINEER DIV, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY
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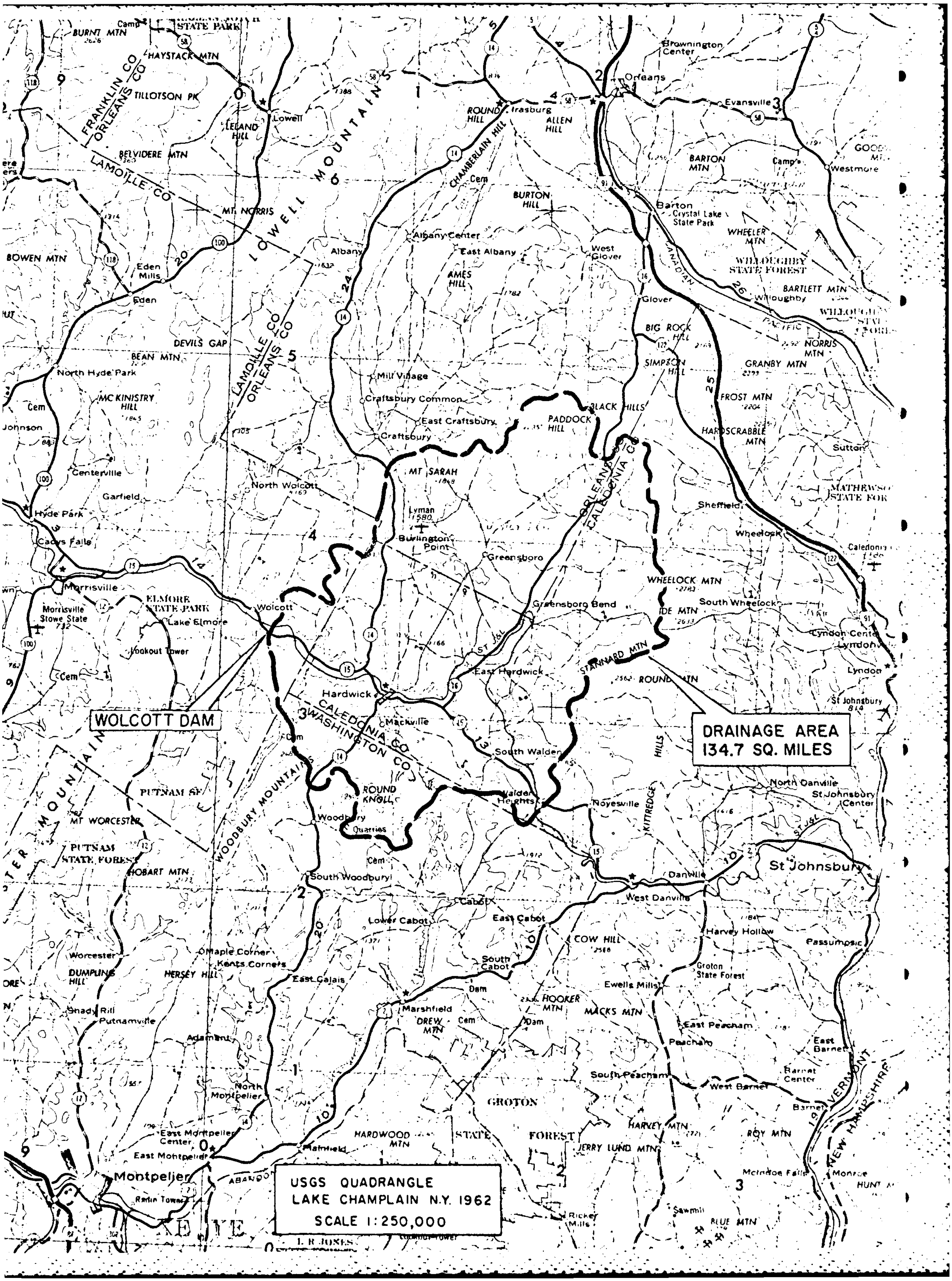
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Wolcott Dam
Wolcott, Vermont
VT 00179
May, 1980

APPENDIX D

HYDRAULICS/HYDROLOGIC COMPUTATIONS

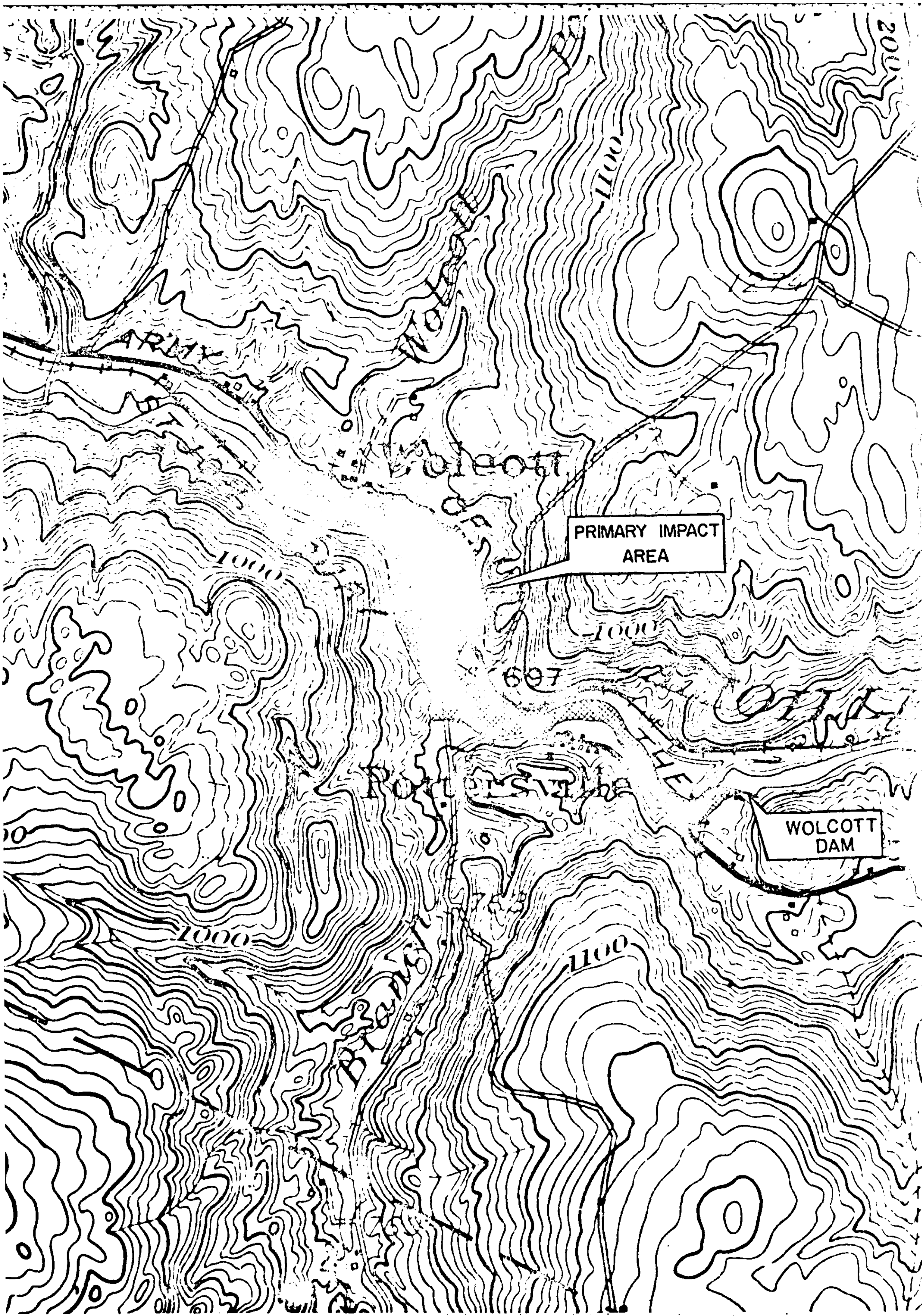


WOLCOTT DAM

DRAINAGE AREA
134.7 SQ. MILES

USGS QUADRANGLE
LAKE CHAMPLAIN N.Y. 1962
SCALE 1:250,000

STATE PARK
BURNT MTN
HAYSTACK MTN
TILLOTSON PK
FRANKLIN CO
ORLEANS CO
LELAND HILL
Lowell
BELVIDERE MTN
LAMOILLE CO
LOWELL MOUNTAINS
MT. NORRIS
Brownington Center
Orleans
Evansville
ROUND HILL
Irasburg
ALLEN HILL
CHAMBERLAIN HILL
BARTON MTN
Camp
Westmore
Barton
Crystal Lake State Park
WHEELER MTN
WILLOUGHBY STATE FOREST
BARTLETT MTN
Willoughby
BURTON HILL
Albany Center
East Albany
Albany
West Glover
AMES HILL
Glover
BOWEN MTN
Eden Mills
Eden
DEVILS GAP
BEAN MTN
North Hyde Park
LAMOILLE CO
ORLEANS CO
BIG ROCK HILL
SIMPSON HILL
GRANBY MTN
NORRIS MTN
Mill Village
Craftsbury Common
East Craftsbury
Craftsbury
MC KINISTRY HILL
Johnson
BLACK HILLS
PADDOCK HILL
FROST MTN
HARDSCRABBLE MTN
Sutton
Centerville
Garfield
North Wolcott
MT SARAH
Lyman
Hyde Park
Cadys Falls
Burlington Point
Greensboro
ORLEANS CO
CALEDONIA CO
Sheffield
Wheelock
MATHEWSON STATE FOREST
Caledonia
Morrisville
ELMORE STATE PARK
Morrisville Stowe State
Lake Elmore
Wolcott
Greensboro Bend
WHEELOCK MTN
South Wheelock
IDE MTN
Lyndon Center
Lyndonville
Lookout Tower
STANNARD MTN
ROUND MTN
East Hardwick
Lyndon
Hardwick
Mackville
CALEDONIA CO
WASHINGTON CO
St Johnsbury
South Walden
HILLS
PUTNAM SF
WOODBURY MOUNTAINS
ROUND KNOLL
Walden Heights
Noyesville
North Danville
St Johnsbury Center
MT WORCESTER
Woodbury
Quarries
KITTREDGE
PUTNAM STATE FOREST
HOBART MTN
Cem
South Woodbury
Danville
St Johnsbury
West Danville
Cabot
East Cabot
Lower Cabot
COW HILL
Harvey Hollow
Passumpsic
Worcester
Maple Corner
Kents Corners
South Cabot
DUMPLING HILL
HERSEY HILL
East Calais
Groton State Forest
Ewells Mills
Shady Rill
Putnamville
Marshfield
Dam
HOOKER MTN
MACKS MTN
DREW MTN
Adamant
East Peacham
Peacham
East Barnet
South Peacham
West Barnet
Barnet Center
VERMONT
NEW HAMPSHIRE
North Montpelier
GROTON
Barnet
East Montpelier Center
East Montpelier
HARDWOOD MTN
Plainfield
STATE
FOREST
HARVEY MTN
JERRY LUND MTN
ROY MTN
Montpelier
Radio Tower
McIndoe Falls
Monroe
Ricker Mills
Sawmill
BLUE MTN


PRIMARY IMPACT AREA
WOLCOTT DAM
Wolcott
Pottersville
ARMY
Branch
1000
1100
697
200

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 1 of 21

ubject Inspection of non-federal dams

omputation Wolcott Dam

Job No. 953-05G

omputed by MEB

Checked by SDM

Date 8-12-80

Hydrologic / Hydraulic Inspection

I. Performance at Test Flood Conditions

1. Maximum Probable Flood

a) Watershed classified as "rolling" ✓

b) Watershed area

134.7 mi² Planimeter from USGS sheets [illegible] are at the trials

130 mi² Vt. Dept. of Water Resources Inf. Sheet

Several small lakes are located within the drainage area, notably Hardwick Lake, Caspian Lake, Eligo Pond, East Long Pond, [illegible] Pond and [illegible] Pond. The total surface area of these is less than 2% of the entire watershed area and the storage effect of these lakes is deemed negligible.

c) From NED-ACE "Preliminary Guidance for Estimating Max. Probable Discharges" - Rolling Curve for MPF - Peak Flow Rates

PMF ≈ 875 cfs/mi² for Total Drainage Area

PMF → 875 cfs/mi² × 134.7 mi² = 117[illegible] cfs

½ PMF = 58,931 cfs

Sheet 2 of 21

bject Inspection of non-fed dams

mputation Wolcott Dam Job No. 953-056

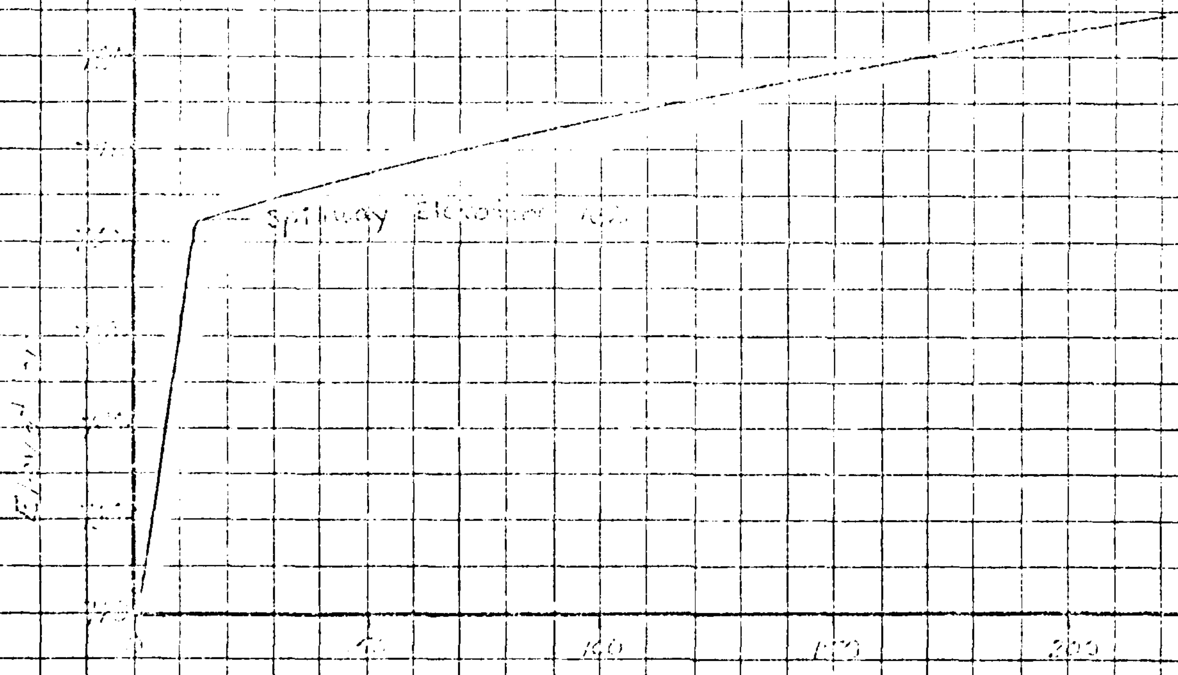
mputed by NEB Checked by SDM Date 8-12-80

2) Test Flood

a) Classification of dams according to NED-ACE Recommended Guidelines

1. Size

Elevation vs. Surface Area



Elevation of [illegible] Area [illegible]

Normal pool el. 762 [illegible] (762-719) [illegible] acre-ft

Top of dam el. 770.87' [illegible] (770.87-762 [illegible]

([illegible]) = 615 acre-ft

See Stage-Storage curve on p. 3

Storage (max) = 615 acre-feet (top of dam el. 770.87)

Height = 770.87-719 = 51.87'

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 3 of 21

ject Inspection of non-federal dams

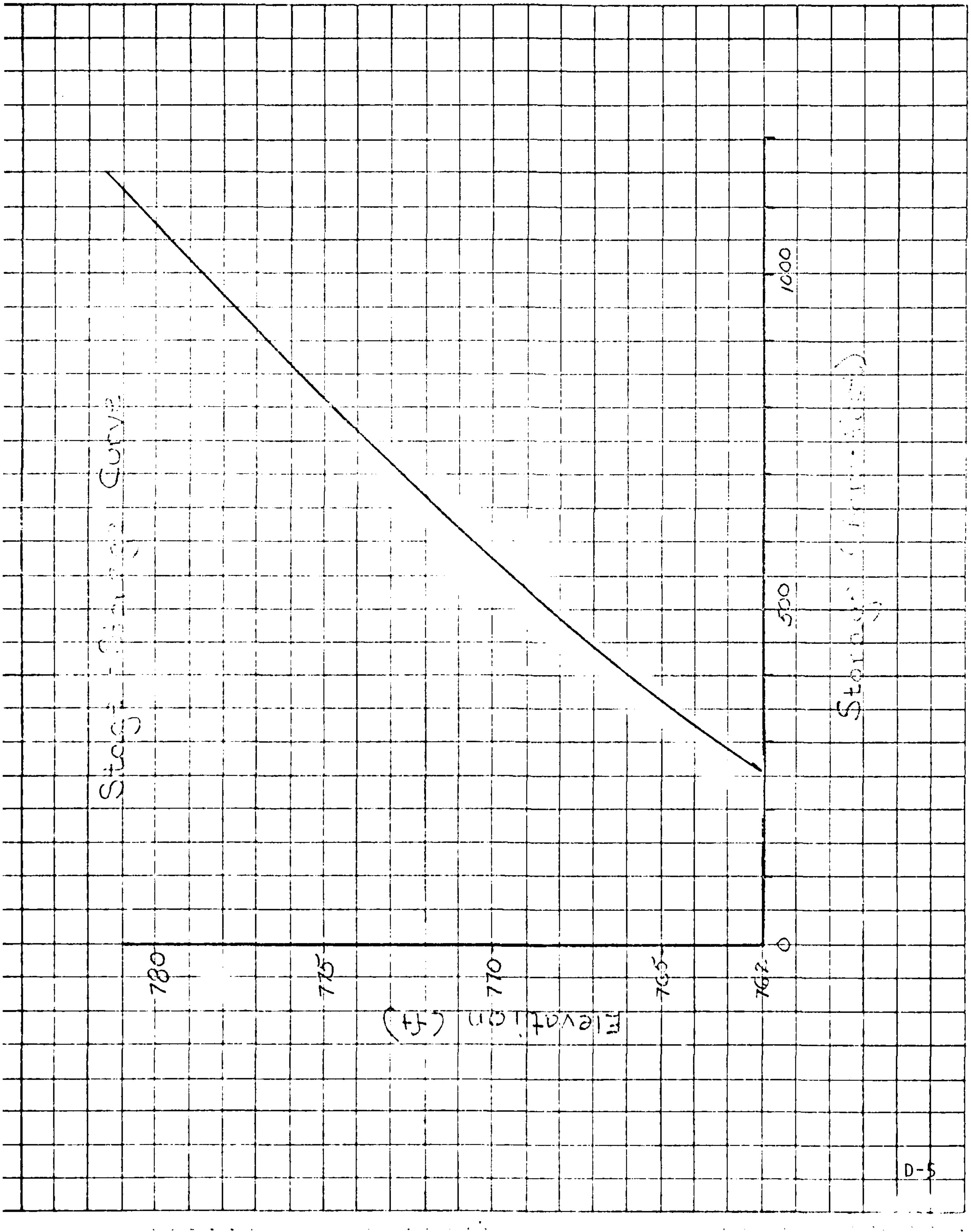
putation Wolcott Dam

Job No. 953-05G

puted by MEB

Checked by SDM

Date 8-12-80



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 4 of 21

ect Inspection of non-federal dams

utation Wolcott Dam Wolcott, Vt Job No. 953-056

uted by MEA Checked by SDM Date 8-13-80

2. Hazard Potential

Failure [illegible]

175 [illegible]

[illegible]

3. Classification

Size: Intermediate [illegible]

HAZARD: [illegible]

4. Test Flood = PMF = 117,863 cfs

½ PMF = [illegible] cfs

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 5 of 21

t Inspection of non-federal dams

ation Wolcott Dam Wolcott, Vt Job No. 953-05-G

ed by MEB Checked by SDM Date 6-23-80

) Surcharge at Peak Inflow

a) Peak Inflow $Q_{p_1} = 11783$ cfs
$Q_{p_1}' = 58931$ cfs

b) Out Flow Rating Curve

pillways [illegible]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	78?
[illegible]	[illegible]	778
[illegible]	[illegible]	77?
[illegible]	[illegible]	7??

14	[illegible]	[illegible]
16	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	79?

utlet Pipe D [illegible]

[illegible]	59?	2	73?
[illegible]	514	6	740
[illegible]	6??	10	744
[illegible]	[illegible]	14	79?
[illegible]	[illegible]	[illegible]	[illegible]
24.??	[illegible]	[illegible]	7??
37.9?	1071	[illegible]	76?
??.27	[illegible]	[illegible]	[illegible]
43.??	122?	[illegible]	[illegible]
45.??	[illegible]	[illegible]	[illegible]
49.??	12??	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Sluiceway Pier L = 13-3?
C = 2.?
$Q = C\,L\,H^{3/2}$ El. 772

H	Q	Elev
2	99	774
4	277	776
6	509	778
8	78?	7??
10	1016	792

Sheet 19 of 21

Inspection of non-federal dams

tion Wolcott Dam Wolcott Vt Job No. 953-050

d by NER Checked by SDM Date 8-12-80

Summary

a) Peak Failure Outflow

Q_p = 44200 cfs ([illegible] = 20250 cfs)

b) Approximate stage before failure

Impact Area: Pottersville H = 13.3'

Wolcott H = 17.7'

c) Approximate stage after failure

Impact Area: Pottersville H = 16.8'

Wolcott H = 21.0'

d) Raise in stage

Impact Area: Pottersville ΔH = 3.5'

Wolcott ΔH = 3.3'

The preceding dam failure analysis taken with the pool at the top of the dam, indicates the downstream stage [illegible] failure. The following dam failure analysis will be [illegible] with the pool at spillway crest to establish the [illegible] hazard.

Pre-failure Flow = 1071 cfs

Reservoir Storage at Time of Failure = 258 acre-ft

Peak Failure Flow = Breach Outflow

(No flow over spillway or through outlet works [illegible] inoperative [illegible] dam failure)

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

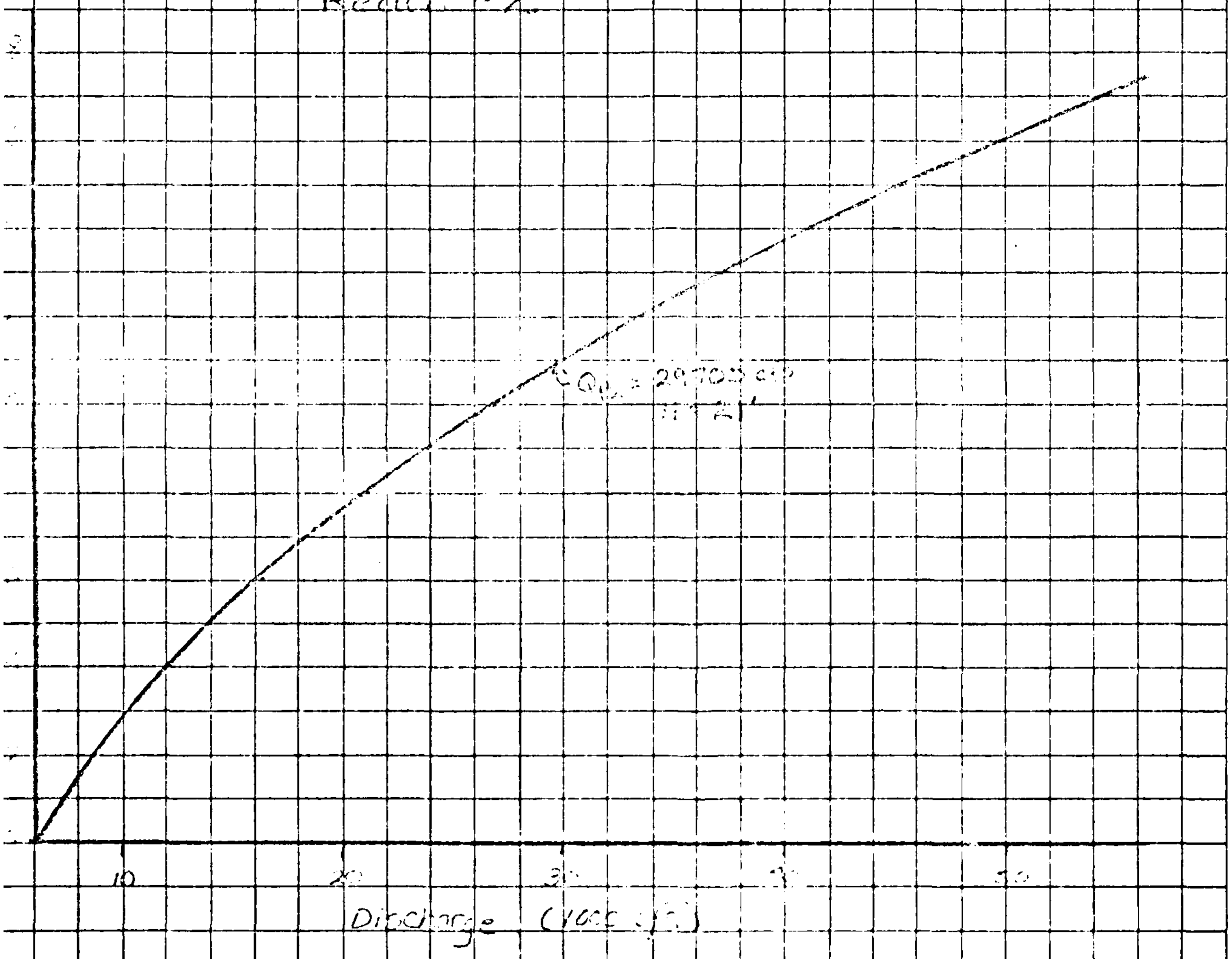
Sheet 18 of 21

t Inspection of non-federal dams

ation Wolcott Dam Wolcott Vt Job No. 953-056

ed by MEB Checked by SDM Date 6-26-80

Downstream Channel @ Town of Wolcott
Reach #2



Sheet 17 of 21

ect Inspection of non-federal dams

utation Wolcott Dam Wolcott, Vt Job No. 953-050

uted by MEB Checked by SDM Date 6-26-80

Downstream Channel @ Town of Wolcott Reach #2

Section @ Flood Plain

H	A	P	R	V	Q
10	30	66	0.5	.22	[illegible]
12	226.5	[illegible]	2.43	.93	211
14	[illegible]	79	4.21	1.3[illegible]	55[illegible]
16	[illegible]	[illegible]	5.83	1.69	1044
18	[illegible]	[illegible]	7.48	1.97	1651
[illegible]	[illegible]	[illegible]	[illegible]	2.23	2276
[illegible]	[illegible]	[illegible]	10.47	2.4[illegible]	3219
[illegible]	[illegible]	[illegible]	11.8[illegible]	[illegible]	4178
[illegible]	[illegible]	[illegible]	13.26	2.8[illegible]	5257
[illegible]	[illegible]	[illegible]	14.[illegible]	[illegible]	[illegible]

Section @ Flood Plain

H	A	P	R	V	Q
10	30	60	0.5	.32	5
12	240	120	2	.82	196
14	540	180	3	1.07	578
16	[illegible]	240	4	1.30	1215
18	1500	300	5	[illegible]	2257
20	2160	[illegible]	6	1.74	[illegible]
22	2940	420	7	1.8[illegible]	[illegible]
24	3840	480	8	2.0[illegible]	7999
26	4860	540	9	2.23	10821
28	[illegible]	[illegible]	10	[illegible]	14331

Rating Curve (Q sum)

H	Q	H	Q
10	5765	20	2708[illegible]
12	8572	22	3351[illegible]
14	12081	24	41[illegible]
16	163[illegible]	26	49615
18	21293	28	[illegible]

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 16 of 21

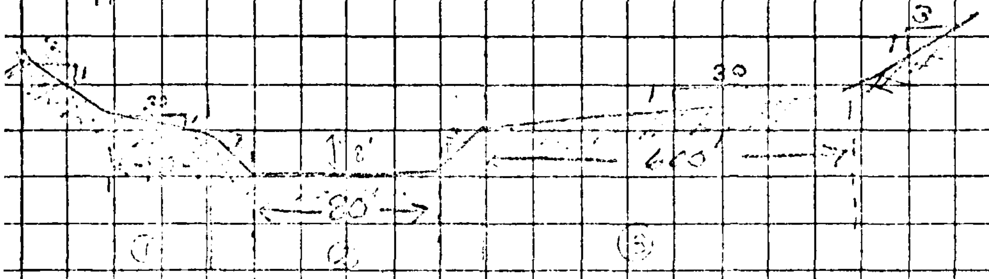
ject Inspection of non-federal dams

putation Wolcott Dam Wolcott, Vt Job No. 953-056

puted by MEB Checked by SDH Date 6-26-80

Downstream Channel @ Town of Wolcott Reach #2

Approximate Cross-section



$V = \frac{1.486}{n} R^{2/3} S^{1/2}$ S = .00[illegible] (USGS sheet) Q = AV

n = 0.010 stream bed

n = 0.16 flood plain

H	A	P	R	V	Q
2	172	93	1.8[illegible]	1.9[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	2.[illegible]	[illegible]
6	[illegible]	11[illegible]	[illegible]	3.76	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	4.4[illegible]	[illegible]
10	[illegible]	12[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	12[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	12[illegible]	12.2[illegible]	[illegible]	10915
16	[illegible]	12[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	236[illegible]	121	15.1[illegible]	[illegible]	216[illegible]
[illegible]	[illegible]	12[illegible]	[illegible]	9.51	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	10.12	[illegible]
[illegible]	313[illegible]	[illegible]	[illegible]	10.71	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sheet 15 of 21

ject Inspection of non-federal dams

iputation Wolcott Dam Job No. 953-056

iputed by MEB Checked by SDM Date 8-8-80

Reach #2 3000-5500 ft. D/S of the dam
Road crossing at D/S end of
reach @ Town of Wolcott

Pre-failure Stage $Q_s = 20250$ cfs $H = 17.7'$
(Stage-Discharge curve plotted on p. 18)

Volume between prefailure and post-failure stages:
$Q_{p_1} = 37400$ cfs $H = 23.1'$
$V_1 = 438 - 246 = 192$ acre-ft (x-sect following page)
$V_1 < 1/2\ S$ $\therefore$ O.K

Q_{p_2} (Trial) $= Q_{p_1}\left(1 - \frac{V_1}{S}\right)$
$= 37400\ (1 - 192/615)$
$\cong 25700$ cfs $H = 19.6'$
$V = 307 - 246 = 61$ acre-ft

$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_{av}}{S}\right)$
$= 37400\left(1 - \frac{(192+61)/2}{615}\right)$
$\cong 29700$ cfs

Post-failure Stage $Q_p = 29700$ cfs $H = 21'$

Raise in stage $= 21 - 17.7 = 3.3'$

Sheet 14 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam Wolcott Vt Job No. 953-056

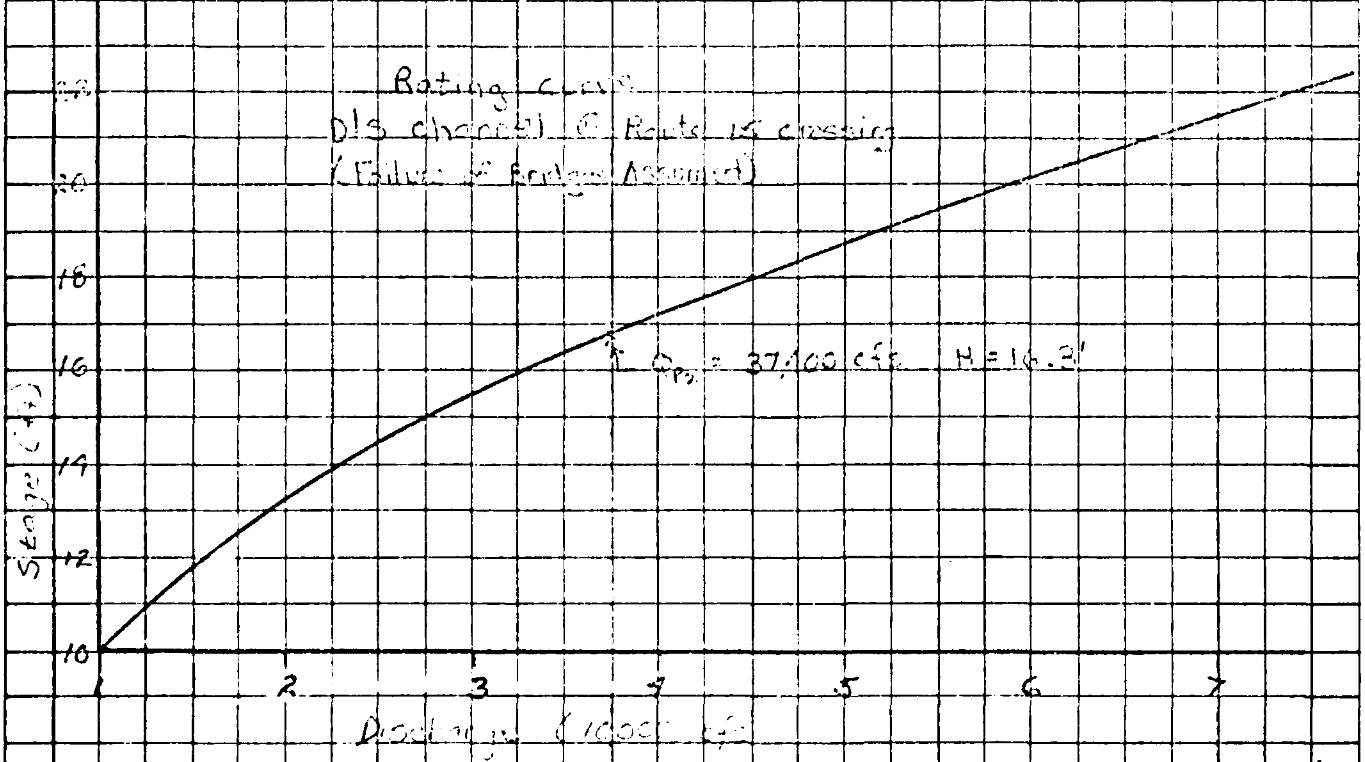
Computed by MEB Checked by SDM Date 2-26-80

Reach #1 cont.

②	H	A	P	R	V	Q
	12	150	75	2	2.2	420
	14	300	"	4	[illegible]	[illegible]
	[illegible]	[illegible]	"	6	[illegible]	[illegible]
	[illegible]	[illegible]	"	8	[illegible]	[illegible]
	[illegible]	[illegible]	"	10	[illegible]	[illegible]
	[illegible]	[illegible]	"	12	[illegible]	[illegible]

[illegible] (Cont.)

H	Q	H	Q
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	22179	[illegible]	[illegible]
[illegible]	[illegible]		


Rating curve
D/S channel @ Route 15 crossing
(Failure of Bridge Assumed)

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 13 of 21

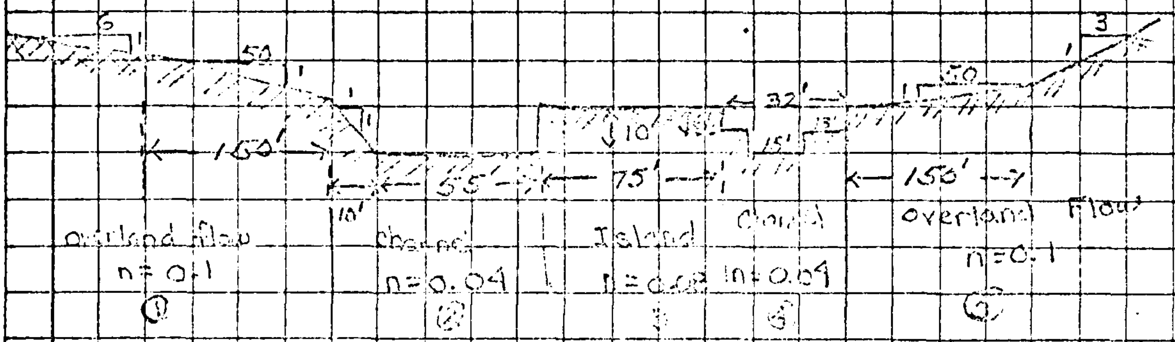
Subject

Computation Wolcott Dam Wolcott Vt Job No. 953-056

Computed by McP Checked by SDM Date 6-26-80

D/S Channel at Route 15 crossing Reach #1

Approximate Cross-section


6
1
50
1
1
1
← 150' →
10'
55'
75'
10'
15'
32'
15'
3
1
50
← 150' →
overland flow
n = 0.1
①
channel
n = 0.04
②
Island
n = 0.08
③
Channel
n = 0.04
④
overland flow
n = 0.1
⑤

Manning $V = \frac{1.486}{n} R^{2/3} S^{1/2}$ S = .009 (from USGS sheets)

Q = AV

① H	A	P	R	V	Q
12	100	160	1	1.4	141
14	378	156.1	2.42	[illegible]	961
16	720	169.2	4.17	[illegible]	[illegible]
18	[illegible]	[illegible]	5.9	[illegible]	4710
20	1472	182.5	7.39	[illegible]	7602
22	1818	204.7	8.8	[illegible]	[illegible]

⑤ H	A	P	R	V	Q
10	100	160	1	1.4	141
14	316.5	153.3	2.06	2.57	[illegible]
16	[illegible]	161.6	4.32	3.71	[illegible]
18	1012.5	165.8	6.10	4.7	[illegible]
20	1349.5	172.1	7.83	5.55	[illegible]
22	[illegible]	178.1	9.51	6.38	10783

② H	A	P	R	V	Q
10	600	79.1	7.58	13.6	[illegible]
12	730	"	9.23	15.3	11320
14	[illegible]	"	10.57	17.3	14275
16	920	"	[illegible]	19.0	18569
18	1,20[illegible]		[illegible]	20.6	[illegible]
20	[illegible]		[illegible]	22.7	27713
22	[illegible]		17.4	22.9	32716

④ H	A	P	R	V	Q
10	252	52	4.85	[illegible]	[illegible]
12	316	"	6.08	11.79	[illegible]
14	[illegible]	"	7.31	13.27	[illegible]
16	444	"	8.54	14.72	6537
18	508	"	9.77	16.1	[illegible]
20	572	"	11.0	17.43	9971
22	636	"	[illegible]	18.71	[illegible]

Sheet 12 of 21

Subject: Inspection of non-fed dams

Computation: Walcott Dam Job No. 953-056

Computed by: MEB Checked by: Date: 8-8-80

c) Peak Failure Outflow

Peak Failure Outflow = Breach Outflow + Remaining Spillway Flow

Q_p = 30,300 + 13,900 cfs
= 44,200 cfs ✓

2. Peak Stage in Immediate Impact Area

Reach #1 800-3000 ft D/s of the dam
[illegible] (Assumed no significant storage within
0-800 ft. downstream as the [illegible]
Route 15 crossing at D/s end of reach)

Prefailure Stage Q_1 = 20250 cfs H = 13.3'
(Stage-Discharge curve plotted on p.14)

Reservoir Storage at Time of Failure = 615 acre-ft
(Stage-Storage curve plotted on p. 3)

Volume between pre-failure and post-failure stages:
V_1 = 211 - 99 = 112 acre-ft (x-sect following page
$V_1 < 1/2\ S$ ∴ O.K.

Q_{p_1} = 44200 H = 17.8'

Q_{p_2} (Trial) $= Q_{p_1}\left(1 - \frac{V_1}{S}\right)$
$= 44200\left(1 - 112/615\right)$
$\doteq$ 36000 cfs H = 16.9 V = 176 - 99 = [illegible]

$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_{av}}{S}\right)$
$= 44200\left(1 - \frac{(112 + 77)/2}{615}\right)$
$\doteq$ 37400 cfs

Post-failure Stage Q_{p_2} = 37400 cfs H = 16.8'
Raise in stage = 16.8 - 13.3 = 3.5'

Sheet 11 of 21

Subject Inspection of non fed dams

Computation Wolcott Dam

Job No. 953-056

Computed by MEB

Checked by SDM

Date 8-8-80

II Downstream Failure Hazard

1. Peak Failure Flow

a) Breach Outflow

Mid-height Elevation (770.87-719)/2 + 719 ≅ 745

Approx. Mid-height Length = 120' (from Dwg. Plan)

∴ Breach Width = 0.4 × 120 = 48' = W_b

Assume surcharge to top of dam El. 770.87

∴ Height at time of failure h_b = 52'

Breach Outflow = $Q_{p} = (8/27)\, W_b \sqrt{g}\, h_b^{3/2}$

W_b = 48'

h_b = 52'

∴ $Q_p \cong$ 30,300 cfs

b) Remaining Spillway Discharge

Breach assumed to occur in the spillway section on the right side of the dam.

186' - 48' = 138' of spillway remaining

$Q = CLH^{3/2}$ C = 3.8 L = 138 El 767

H	Q	W.S. El
3.87	13853	770.87

$Q_s \cong$ 13,900 cfs

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 10 of 21

Subject Inspection of non-federal dams

Computation Walcott Dam Walcott Vt.

Job No.

Computed by MEB

Checked by SDH

Date 6-24-80

F) Spillway Capacity to Outflow

Spillway Capacity to Top of Dam Q_s = 18672 cfs

∴ Spillway capacity is ≈ 16% of the [illegible] PMF and ≈ 33% of the [illegible] ½ PMF

5) Summary

a) Peak Inflow Q_{p_1} = 117863 cfs
Q_{p_1} = 58931 cfs

b) Peak Outflow Q_{p_2} = 114,800 cfs
Q_{p_3} = 57,000 cfs

c) Spillway Max Capacity Q_s = 18,672 cfs
≈ 16% of Q_{p_2} and ≈ 33% of Q_{p_3}

Therefore at Test Flood = PMF, the dam is overtopped by ≈10.6' [illegible] surcharge above the spillway crest of ≈19.5'

At ½ PMF the dam is overtopped by ≈5.3' or to a [illegible] surcharge above the spillway crest of 14.2'

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 9 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam Wolcott, Vt Job No. 953-05 G

Computed by MEB Checked by SDM Date 6-24-80

b) Assume Normal Pool level at Spillway Crest El. 762 ✓

c) Watershed Area: D.A. = 131.7 mi² ✓

d) Discharges (Q_{p2}) at Various Surcharge Heights

H = 18' V = 180 acres × 18' = 3240 ac-ft

S = 3240 / (53.3 × 131.7) = .45"

H = 22' V = [illegible] = 3960 ac-ft

S = 3960 / ([illegible] × 131.7) = .55"

Use Approximate Storage Routing Guidelines
"19" [illegible] Rainfall" [illegible]

$Q_{p2} = Q_{p1}(1 - S/19)$ and for ½ PMF $Q_{p2}' = Q_{p1}'(1 - S/9.5)$

∴ For H = 18' Q_{p2} = 115072 Q_{p2}' = 56140

For H = 22' Q_{p2} = 114451 Q_{p2}' = 55519

e) [illegible]

Using NED ACE Guidelines "Surcharge Storage Routing Alternate Method"

Q_{p2} = 114,800 cfs H = 19.5' For Q_p = PMF

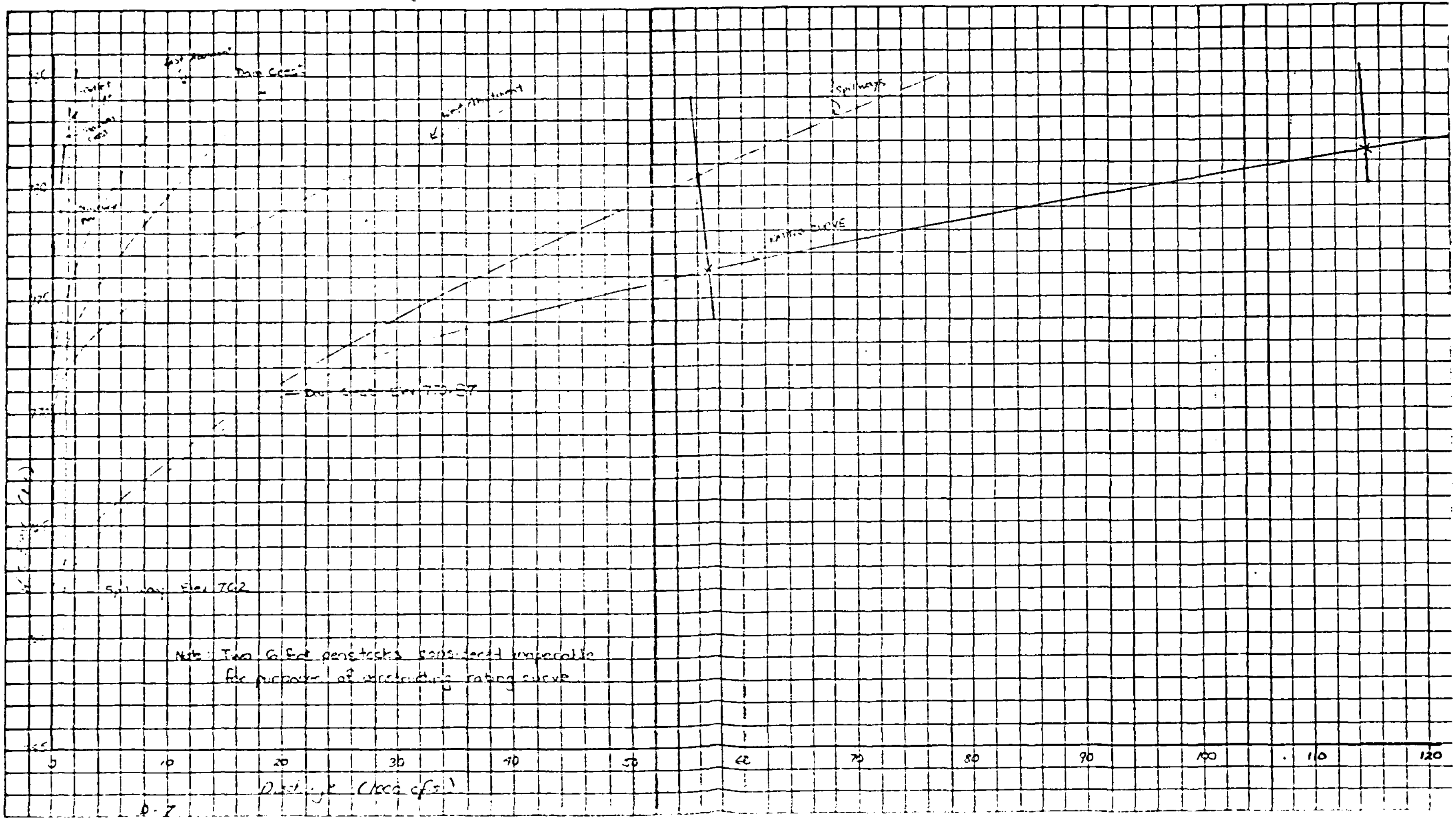
Q_{p2}' = 57,000 cfs H = 14.2' For Q_p = ½ PMF

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers
Sheet 8 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam, Wolcott Vt Job No. 953-05 G

Computed by MEB Checked by SDH Date 6-24-80



Note: Two 6 ft penstocks considered inoperable for purposes of constructing rating curve

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 7 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam Wolcott Vt

Job No. 953-05 S

Computed by MEB

Checked by SPK

Date 6-24-80

[illegible] Crest Elev 772.87 L = [illegible] Q = [illegible]

H	[illegible]	WS Elev	H	Q	[illegible]
1.13	31	774	[illegible]	325	[illegible]
3.13	144	776	[illegible]	717	78[illegible]
5.13	3[illegible]	778			

Rating Curve [illegible]

Q	[illegible]	Q	[illegible]
10,711	77[illegible]	[illegible]	774
3110	[illegible]	55928	77[illegible]
6874	7[illegible]	[illegible]	[illegible]
11610	[illegible]	[illegible]	
17392	[illegible]	[illegible]	
[illegible]	77[illegible]		

a) Spillway [illegible]

H = [illegible] Q = 18672 16 [illegible] 32 [illegible]

b) [illegible] Height [illegible] Qp

i) Qp = 117,863 cfs H = 19.7

ii) ½ Qp = 58931 cfs H = 14.5'

4) Effect of Surcharge on Max Probable Discharge

a) Lake [illegible]

[illegible] Dam [illegible]

12 [illegible]

at [illegible] 732 [illegible] 12 [illegible]

176 [illegible]

[illegible] 750 [illegible]

[illegible]

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 6 of 21

Subject: Inspection of non-federal dams

Computation: Wolcott Dam Wolcott, Vt

Job No. 953-056

Computed by: MEB

Checked by: [illegible]

Date: 6-24-80

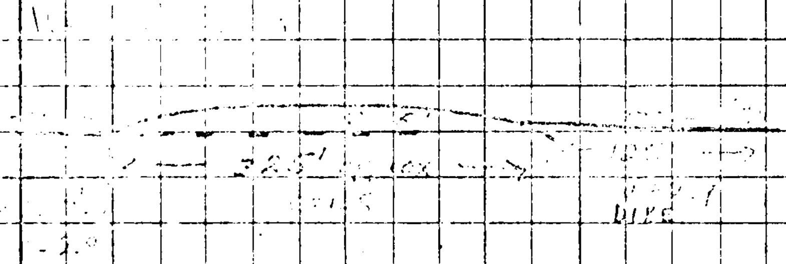
Dam Crest Elev. [illegible] [illegible] C=2.9 L=[illegible] C=2.[illegible]

H	Q	[illegible] Elev
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

H	Q	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Q = [illegible]

Q	[illegible]	Q	[illegible]
[illegible]	772	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]



[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	772
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	772
[illegible]	[illegible]	77[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	77[illegible]

H	Q	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	1734	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

H	Q	[illegible]
[illegible]	[illegible]	772
[illegible]	[illegible]	774
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 20 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam Wolcott Vt

Job No. 953-05G

Computed by MEB

Checked by SDM

Date 8-12-80

Breach Outflow

H_o = Height at time of failure = 43'

W_b = Breach width (page 11) = 48'

$Q_{p_1} = \frac{8}{27} W_b \sqrt{g} H_o^{3/2}$

Q_{p_1} ≅ 22,800 cfs = Peak failure outflow

Reach #1 (see pages 12, 13, 14) [illegible]

Volume between pre-failure and failure stage:

V_1 = 116 - 9 = 107 acre-feet [illegible] 4.5'

$V_1 < S/2$ ∴ Reach O.K.

Q_{p_2} (trial) = $Q_{p_1}(1 - \frac{V_1}{S})$

= 22800 $(1 - \frac{107}{2[illegible]})$

≅ 13300 cfs H = 11.6' V = 63 - 9 = 54 acre-ft

$Q_{p_2} = Q_{p_1}(1 - \frac{V_{avg}}{S})$

= 22800 $(1 - \frac{(107+54)/2}{2[illegible]})$

≅ 15700 cfs

Failure Outflow = 15700 cfs H ≅ 12'

Reach #2 (see pages 15, 16, 17) Wolcott

Prefailure Stage ≅ 4'

Volume between pre-failure and post failure stages:

V_1 = 187 - 21 = 166 acre-ft

$V_1 > S/2$ ∴ Select shorter Reach

Assume equivalent x-sect, divide reach in half

(Reach 2a) L = 11[illegible]

V_1 ≅ 93.5 - 10.5 = 83 acre-ft

Q_{p_2} (trial) = $Q_{p_1}(1 - V/S)$

= 15700 $(1 - 83/2[illegible])$

≅ 10660 cfs H = 13.' V = 63.3 - 10.5 = 52.8

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 21 of 21

Subject Inspection of non-federal dams

Computation Wolcott Dam Wolcott Vt

Job No. 953-056

Computed by MEB

Checked by SDM

Date 8-12-80

(Reach 2A cont.)

$Q_{p2} = Q_{p1} \left(1 - \frac{V_{av}}{S}\right)$

$= 15700 \left(1 - \frac{(83 + 520)12}{258}\right)$

$\cong 11600$ cfs $H = 12.5'$

(Reach 2B) $V_1 = 71.1 - 10.5 = 60.6$

Q_{p2} (trial) $= Q_{p1} (1 - V_1/S)$

$= 11600 (1 - $ [illegible] $)$

$\cong$ [illegible] cfs $H = 12'$ $V = 52 -$ [illegible]

$Q_{p2} = Q_{p1} (1 - V_{av}/S)$

$= 11600 \left(1 - \frac{(60.6 + \text{[illegible]})12}{\text{[illegible]}}\right)$

$\cong 9300$ cfs $H = 12.5'$

Summary - "Low Flow Failure"

a) Peak Failure Outflow = 22,900 cfs
Pre-Failure Flow = 1071 cfs

b) Approximate stage before failure
Impact Areas: Pottersville H = 2.5'
Wolcott H = 1.0'

c) Approximate stage after failure
Impact Areas: [illegible] H = 12'
Wolcott H = 12.5'

d) Raise in stage
Impact Areas: Pottersville ΔH = 9.5'
Wolcott ΔH = 9.5'

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

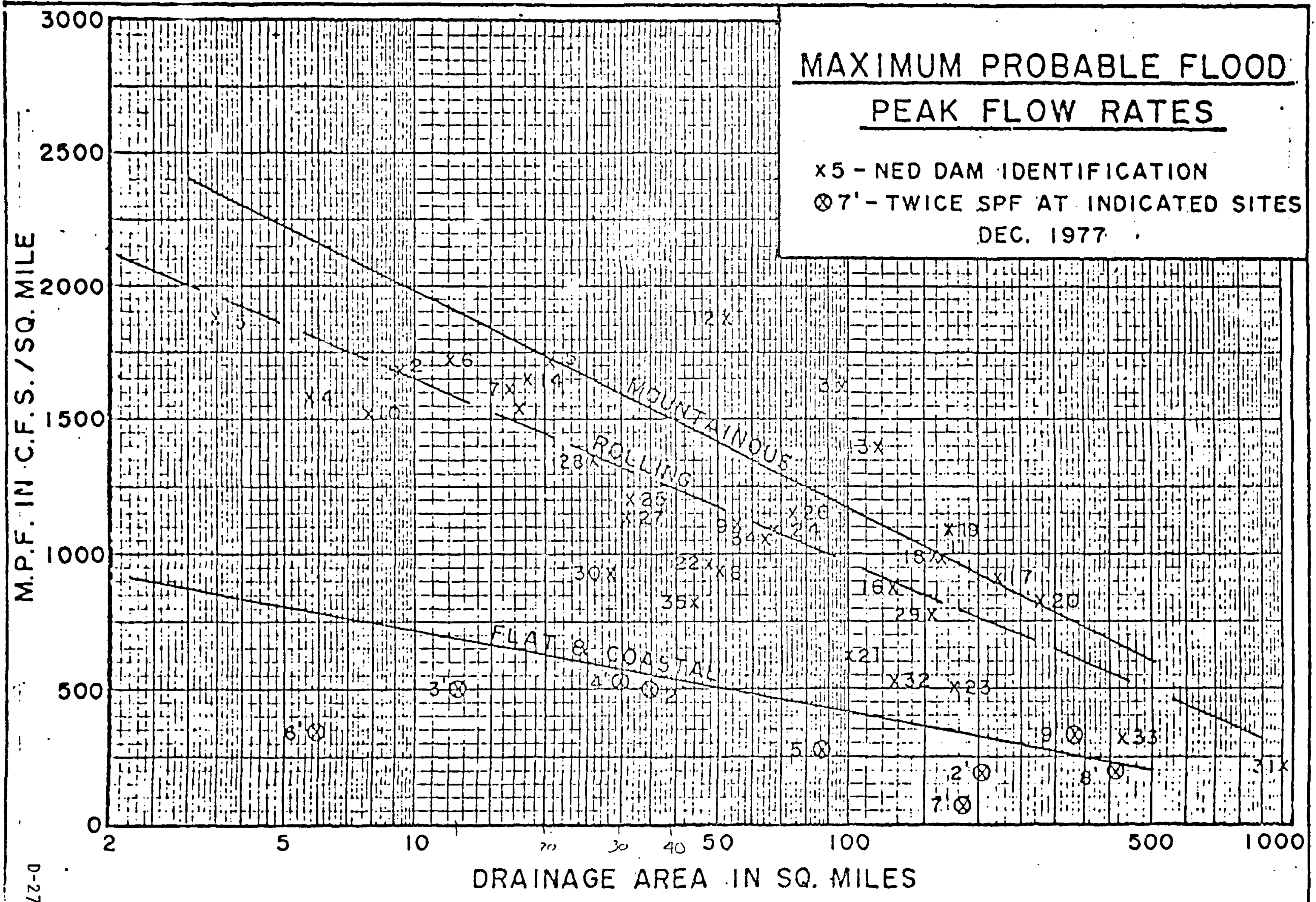
MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS BASED ON TWICE THE STANDARD PROJECT FLOOD

(Flat and Coastal Areas)

	River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1.	Pawtuxet River	19,000	200	190
2.	Mill River (R.I.)	8,500	34	500
3.	Peters River (R.I.)	3,200	13	490
4.	Kettle Brook	8,000	30	530
5.	Sudbury River.	11,700	86	270
6.	Indian Brook (Hopk.)	1,000	5.9	340
7.	Charles River.	6,000	184	65
8.	Blackstone River.	43,000	416	200
9.	Quinebaug River	55,000	331	330



MAXIMUM PROBABLE FLOOD

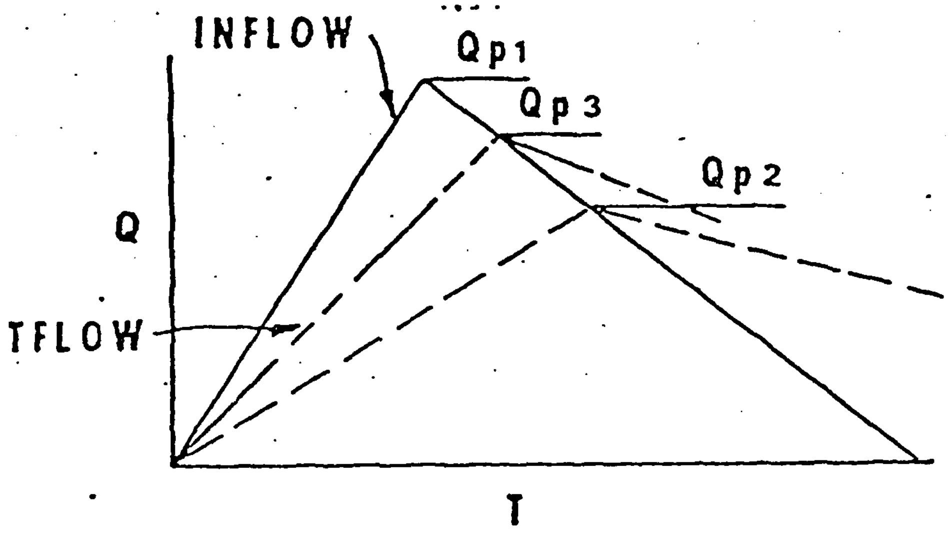
PEAK FLOW RATES

x5 - NED DAM IDENTIFICATION

⊗7' - TWICE SPF AT INDICATED SITES

DEC. 1977

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Q_{p1}".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

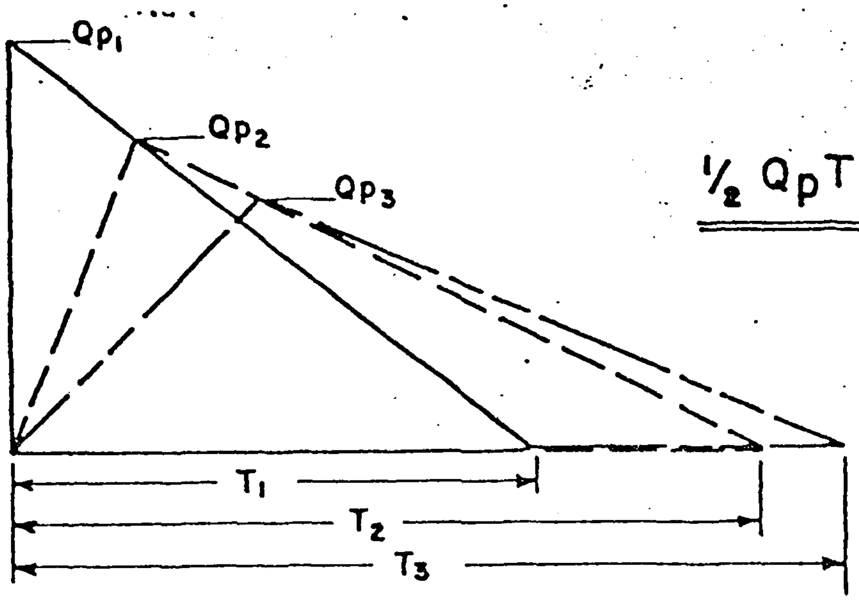
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Q_{p2}"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Q_{p3}".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$$\frac{1}{2} Q_p T = 12\,S$$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27}\, W_b \sqrt{g}\; Y_o^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1\left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1\left(1 - \frac{V_{avg}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

FILMED

8-85

DTIC